PIAGGIO

WORKSHOP MANUAL

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MP3 500 hpe Sport Advanced E5 (2021-)

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WORKSHOP MANUAL
MP3 500 hpe Sport Advanced
E5 (2021-)

WORKSHOP MANUAL
This workshop manual has been drawn up by Piaggio & C. Spa to be used by the workshops of Piaggio dealers. It is assumed that the user of this manual for maintaining and repairing Piaggio vehicles has a basic knowledge of mechanical principles and vehicle repair technique procedures. Any significant changes to vehicle characteristics or to specific repair operations will be communicated by updates to this manual. Nevertheless, no mounting work can be satisfactory if the necessary equipment and tools are unavailable. It is therefore advisable to read the sections of this manual concerning special tools, along with the special tool catalogue.

N.B. Provides key information to make the procedure easier to understand and carry out.

CAUTION Refers to specific procedures to carry out for preventing damages to the vehicle.

WARNING Refers to specific procedures to carry out to prevent injuries to the repairer.

Personal safety Failure to completely observe these instructions will result in serious risk of personal injury.

Safeguarding the environment Sections marked with this symbol indicate the correct use of the vehicle to prevent damaging the environment.

Vehicle intactness The incomplete or non-observance of these regulations leads to the risk of serious damage to the vehicle and sometimes even the invalidity of the guarantee.

INDEX OF TOPICS

INDEX OF TOPICS

GENERAL MANDATORY REQUIREMENTS | NORM

General information

This section contains general information regarding the vehicle and the use of the manual, as well as important notes regarding safety.

IMPORTANT WARNINGS AND NOTES

Each symbol has a precise meaning, as illustrated below.

- WARNING: - This symbol indicates risks for the health of the operator and of the nearby persons if the described procedures are performed incorrectly.
- CAUTION:- This symbol indicates that the component on which works are being performed may be damaged if the described procedures are performed incorrectly.
- NOTE: - This paragraph provides additional instructions for the ongoing procedure, so that the operation may be performed in an efficient manner.

REACH REGULATION WARNINGS :

To protect the health and safety of the PROFESSIONAL CLIENT, as provided by the:

- (EC) Regulation No. 1907/2006 (REACh);
- 2000/53/EC (END of LIFE VEHICLES);
- SCIP Database Directive (art.9, par.1 lett.i) of the framework directive regarding waste, as modified by the Directive 2018/851

The technical personnel operating during the ordinary and special maintenance activities has the obligation to always wear the personal protection equipment:

1. chemical protection gloves if the specific type is not explicitly indicated, or, if required, special gloves according to the substance used;
2. mask, possibly a chemically active one, if specifically required;
3. protective goggles.

The above indications represent an alternative for the prescriptions of other regulations and of the legislation in force in the specific countries. Regarding the use of other PPE, governed by the laws regarding the safety at work, the relevant legislation in force apply.

GENERAL SAFETY WARNINGS :

1. Always wear protective goggles and proper clothing.
2. Always use a safety support to operate under the vehicle.
3. Check that the ignition switch is always OFF, unless the procedure indicates otherwise.
4. Pull the hand brake (if applicable) before starting working on the vehicle.
5. Start the engine only in well ventilated places, to avoid the risks related to the carbon oxide.
6. Keep a safe distance from the mobile parts during the operation of the engine, especially from the fans and belts.
7. To avoid burns, avoid contact with the hot metallic parts, such as the radiator, exhaust manifold, exhaust pipe, catalytic converter and silencer.
8. Do not smoke during maintenance operations.
9. To avoid any injuries, do not wear rings, watches, jewellery and loose clothing before starting to work on the vehicle.
10. Keep your hands and other objects away from the blades of the radiator's fan (if present)!
11. The cooling fan (if present) is fitted on the radiator and may start any time due to a temperature increase of the cooling fluid. It is important to check that the cooling fan's starter motor is disconnected from the wiring harness before starting the works.

The measurement units used in the manual are imperial UNITS of measurement. (International system for UNITS). Example: 24.5-34.3 Nm

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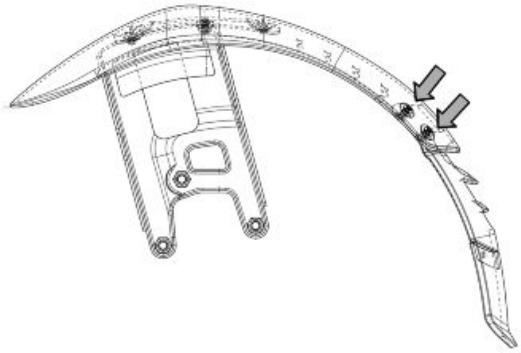
Fit the plastic cover supplied on the joint on the steering tube as shown in the figure.

Proceed as follows if the customer requests installation of splash guards on the vehicle:

- Fit the flap inside the mudguard shown in the figure, matching up the 4 anchor holes.
- Fit the 4 washers and the 4 screws on the outer side of the mudguard, then tighten to the specified torque.



Locking torques (N*m)

splash guard fastener screws **2 to 3**

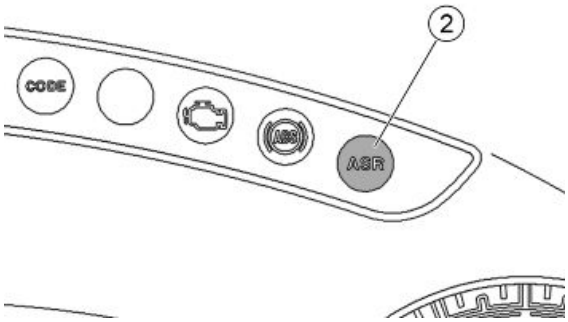
ASR SYSTEM

The ASR system is a driving aid that assists the driver in acceleration manoeuvres, particularly on low-grip surfaces or under conditions that can cause sudden back-wheel slippage. The ASR in these situations automatically intervenes by reducing engine output within the limit imposed by the grip conditions, contributing significantly to the maintenance of stability the vehicle.

WARNING

THE ASR SYSTEM IS BASED ON THE RECOGNITION OF SPEED DIFFERENCES BETWEEN FRONT AND REAR WHEEL. IN ORDER FOR THE SYSTEM TO MAINTAIN MAXIMUM EFFICIENCY IN ALL CONDITIONS, THE CALIBRATION PROCEDURE MUST BE PERFORMED EVERY TIME, EVEN IN CASE OF REPLACEMENT OF JUST ONE TIRE. FOR THE CALIBRATION OF THE CONTROL UNIT PERFORM THE PROCEDURE BELOW.

- ASR BUTTON 1: activation / deactivation.
- ASR WARNING LIGHT «2»: operating indication warning light.



Warning light flashing mode:

- Off with the vehicle in gear:: the system is working, but is not active (normal condition).
- Flashing quickly with moving vehicle: The system is functioning correctly and is active (poor grip conditions, engine power limiting in effect); ride with extreme care, as the grip limit has been exceeded; restore the vehicle to safety conditions by gently reducing the throttle opening.
- Lit with moving vehicle: the system is disabled and will not intervene in case of loss of grip.

- If the deactivation was voluntary (by pressing the appropriate button "1" for 1 second) it is recommended to reactivate the system as soon as possible.
- If the system was NOT deactivated voluntarily, this indicates an ASR system fault.

To ensure maximum safety of the vehicle it is advisable to keep the system active. Deactivation may be necessary only in case of starting with very low grip surfaces (mud, snow) on which the operation of the ASR could actually prevent the movement of the vehicle.

N.B.

AT VEHICLE START-UP THE ASR WARNING LIGHT FLASHES AT THE SAME FREQUENCY AS THE ABS WARNING LIGHT, INDICATING A DIAGNOSTIC PHASE OF THE SYSTEM. IN THE ABSENCE OF ERRORS, BOTH WARNING LIGHTS TURN OFF AT THE SAME TIME WHEN EXCEEDING 5 km/h.

WARNING

THE ASR SYSTEM IS ACTIVATED AT EVERY "ON" POSITIONING OF THE IGNITION SWITCH.
IF DISABLED BY THE USER, THE ASR SYSTEM KEEPS THE STATE OF INACTIVITY ONLY IF THE VEHICLE IS OFF,

BY USING THE ENGINE STOP SWITCH; AT THE NEXT KEY ON THE ASR SYSTEM IS ENABLED AUTOMATICALLY.

CAUTION

IT IS EMPHASISED THAT THE RIDING AUXILIARY SYSTEM CANNOT CHANGE THE PHYSICAL LIMITS OF GRIP AND IS NOT A SUBSTITUTE FOR PROPER MANAGEMENT OF POWER, BOTH ON STRAIGHT STRETCHES AND IN TURNS. THEREFORE, IT IS RECOMMENDED TO ALWAYS USE THE VEHICLE WITH THE UTMOST CARE AND IN ACCORDANCE WITH THE REGULATIONS IN FORCE.

CAUTION

AT LOW SPEED, LESS THAN 5 Km/h (3 mph), THE ASR SYSTEM IS NOT OPERATIONAL.
IT IS RECOMMENDED TO PAY PARTICULAR ATTENTION IN THE EVENT OF ACCELERATION FROM STANDSTILL IN CONDITIONS OF LOW GRIP, ESPECIALLY IN THE FIRST METRES.

N.B.

IN CASE OF ROAD DISCONNECTIONS THERE COULD BE SHORT ACTIVATIONS OF THE ASR SYSTEM. SUCH EVENT APPEARS UNDER NORMAL OPERATION CONDITIONS OF THE VEHICLE.

WARNING

THE ASR SYSTEM PREVENTS THE APPLICATION OF HIGH SPEED ROTATION ON THE REAR WHEEL WITH THE VEHICLE ON THE CENTRE STAND.
IT IS RECOMMENDED TO NOT INSIST WITH THE THROTTLE GRIP IN THIS SPECIFIC SITUATION, BECAUSE THIS MAY CAUSE ABNORMAL STOPS AND/OR DAMAGE TO THE CATALYSTS.

CAUTION

IN THE EVENT OF MALFUNCTION OF THE BATTERY, THE ABS - ASR SYSTEM TURNS OFF.

ASR INDICATOR LIGHT OPERATING MODE

ASR SYSTEM STATUS	ASR INDICATOR LIGHT WITH THE ENGINE SWITCHED OFF OR THE KEY TO "ON"	ASR INDICATOR LIGHT WITH THE ENGINE SWITCHED ON AND THE VEHICLE RUNNING	ASR RUNNING WHILE DRIVING (LOW GRIP CONDITIONS)
ASR ACTIVE and calibrated	"ASR" icon: 1 Hz slow flashing	"ASR" icon: Off	"ASR" icon: 5 Hz fast flashing
ASR ACTIVE not calibrated	-	"ASR" icon: on steady	"ASR" icon: 5 Hz fast flashing
ASR voluntarily deactivated	"ASR" icon: on steady	"ASR" icon: on steady	-
ASR system not working (fault)	"ASR" icon: on steady	"ASR" icon: on steady	-
ASR programming phase (successful)	-	"ASR" icon: 1 Hz slow flashing; at the next engine start, the icon is off if the programming failed.	-
ASR programming phase (failed)	-	"ASR" icon: switched on steady at the next engine start if the programming has failed.	-

ASR SYSTEM CALIBRATION PROCEDURE

To keep the efficiency of the ASR **system after replacing one or both tires, the calibration of the system** must be performed according to the following methods:

• Wait until the diagnostic phase of the ASR and ABS systems is complete;

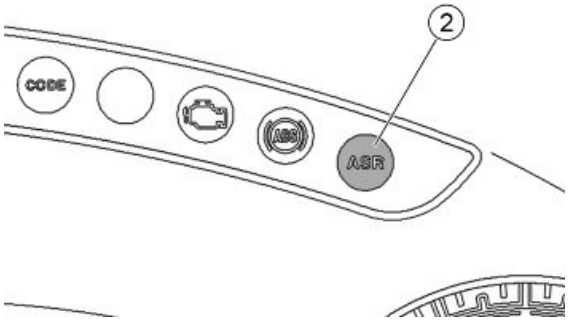
• **Start the engine and drive a short straight stretch of flat road above 5 km / h (3.1 mph)** and wait for the flashing of the two ABS and ASR indicator lights to switch off;

• **Stop** and allow the engine to run in idle for at least **5 seconds**;

• **Press the ASR button "1"** and **the START button for at least 3 seconds.**

• **The activation of the wheel radius learning procedure** or of the ASR calibration procedure **will be confirmed by the ASR indicator light "2" with slow flashing.**

• **Accelerate to a constant speed of** 30-40 km/h (18.6-**24.8 mph)** and maintain it for **at least 8 seconds**. The permanence of the vehicle speed in the correct range for the completion of the procedure is confirmed by the fast flashing of the ASR warning light «**2**».



• **The completion of the procedure** will be indicated by the ASR indicator light **"2"** and now the ASR system **is functional**.

• **To memorize** the procedure, **switch off the engine, turn the ignition switch to "OFF" and wait for at least 60 seconds** before switching again to "**ON**" and engaging a gear.

• **Complete the procedure within 5 minutes;** if the **ASR indicator light "2" stays on steady,** it means that the **ASR procedure has failed**.

Therefore, it is necessary to repeat the ASR calibration procedure until it is successfully completed.

Regarding the ASR indicator light after programming:

- Procedure OK: ASR indicator light OFF and the system active. At the next key "ON", the new wheel radius will be memorized.
- Procedure failed: The ASR indicator light STEADILY ON and the system active (for safety purposes) with the previously memorized or the default wheel radius (if it has never been programmed).

Aesthetic inspection

Appearance check:

- Paintwork
- Fitting of plastics
- Scratches
- Dirt

Tightening torques inspection

Safety locks check

- Safety fasteners
- Fastening screws

Safety fasteners:

- Rear shock absorber upper fixing
- Rear shock absorber lower fixing
- Front shock absorber upper fixing
- Front shock absorber lower fixing
- Sliding shafts fixing
- Brake calliper fixing

- Front wheels fastening screws
- Front wheels axle nut
- Rear wheel axle nut
- Engine - frame oscillating arm fastening
- Handlebar lock nut
- Lateral steering tube lower ring nut
- Lateral steering tube upper ring nut
- Central steering tube lower ring nut
- Central steering tubes upper ring nut
- Constant-velocity universal joints

Electrical system

• Battery

• Main switch

• Lights: high beam lights, low beam lights, taillights (front and rear) and relevant warning lights

- Headlight adjustment according to the regulations currently in force

• Front and rear stop light buttons and bulb

• Turn indicators and their warning lights

• Instrument lighting

• instruments: fuel and temperature indicator

•Instrument panel lights

• Horn

• Electric starter

• Engine stopping with emergency stop switch

• Electric opening of saddle with solenoid

• Tilting system locking - unlocking button

TO ENSURE MAXIMUM PERFORMANCE, THE BATTERY MUST BE CHARGED BEFORE USE. INADEQUATELY CHARGING THE BATTERY WITH A LOW ELECTROLYTE LEVEL BEFORE IT IS USED FOR THE FIRST TIME WITH SHORTEN THE LIFE OF THE BATTERY.

CAUTION

WHEN INSTALLING THE BATTERY, ATTACH THE POSITIVE LEAD FIRST AND THEN THE NEGATIVE ONE.

WARNING

BATTERY ELECTROLYTE IS TOXIC AND IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH EYES, SKIN AND CLOTHING.
IF IT ACCIDENTALLY COMES INTO CONTACT WITH YOUR EYES OR SKIN, WASH WITH ABUNDANT WATER FOR APPROX. 15 MIN. AND SEEK IMMEDIATE MEDICAL ATTENTION.
IF ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.
BATTERIES PRODUCE EXPLOSIVE GAS; KEEP CLEAR OF NAKED FLAMES, SPARKS OR CIGARETTES. VENTILATE THE AREA WHEN RECHARGING INDOORS. ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES.
KEEP OUT OF THE REACH OF CHILDREN.

CAUTION

NEVER USE FUSES WITH A CAPACITY HIGHER THAN THAT RECOMMENDED. USING A FUSE OF UNSUITABLE RATING MAY SERIOUSLY DAMAGE THE VEHICLE OR EVEN CAUSE A FIRE.

Levels check

Level check:

- Hydraulic brake system liquid level.
- Roll lock system fluid level
- Rear hub oil level
- Engine coolant level
- Engine oil level

Road test

Test ride:

- Cold start
- Instrument operations
- Response to the gas command
- Stability on acceleration and braking
- Front and rear brake efficiency
- Parking brake efficiency
- Front and rear suspension efficiency
- Abnormal noise
- Tilting system locking - unlocking efficiency

Static test

Static control after the test drive:

• Hot engine restart
• Minimum seal (turning the handlebar)
• Uniform steering rotation
• Possible losses
• electric radiator fan operation

CAUTION

CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.

CAUTION

NEVER EXCEED THE RECOMMENDED INFLATION PRESSURES SINCE THE TYRES MAY BURST.

Functional inspection

Functional Checks:

• Hydraulic braking system: lever travel

• Clutch: proper functioning check

• Engine: proper general functioning and no abnormal noise check

• Other: papers check, chassis and engine number check, tools and equipment, licence plate fitting, lock check, tyre pressure check, rear-view mirror and any accessory fitting

Specific operations for the vehicle

TOOLKIT

The toolkit comprises:

- a shock absorber pre-load adjusting wrench;

- One fuse puller.

The tools are stored in the helmet compartment.

LICENCE PLATE HOLDER

CAUTION

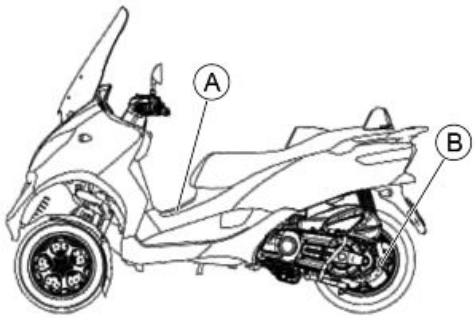
N.B.

ONLY FIT THE LICENCE PLATE HOLDER SUPPLIED AS STANDARD WITH THE VEHICLE, SINCE IT HAS TYPE-APPROVED AND OBLIGATORY SIDE REFLECTORS.

INDEX OF TOPICS

Vehicle identification

Identification registration numbers are made up of a prefix and a number, stamped on the frame and on the engine. The serial number must always be indicated when ordering spare parts. We recommend checking that the frame registration number stamped on the vehicle corresponds with that on the vehicle documentation.



CAUTION

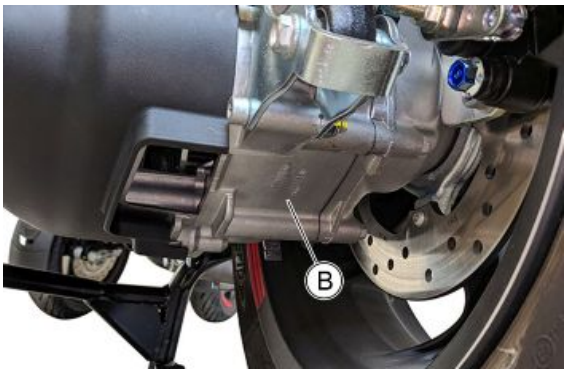
PLEASE REMIND THAT ALTERING IDENTIFICATION REGISTRATION NUMBERS CAN LEAD TO SERIOUS PENAL SANCTIONS (IMPOUNDING OF THE VEHICLE, ETC.).

Frame number

To read the frame number "**A**", open the fuel tank cap access door.

Engine number

The engine number «**B**» is stamped near the rear left shock absorber lower support.



VEHICLE IDENTIFICATION

Specification	Desc./Quantity
Frame prefix	ZAPTD1102
Engine prefix	TD12M

Vehicle data

VEHICLE DATA

Specification	Desc./Quantity
Frame	In tubes and steel sheet metal

Specification	Desc./Quantity
Front suspension	Rolling system composed of a universal joint composed of aluminium rods and of two side tubes and shock absorbers with a hydraulic lock system
Rear suspension	Two gas shock absorbers with pre-load adjustment.
Front brake	Dual 258 mm hydraulically operated disc brakes controlled from RH handlebar lever; braking assisted by ABS system (where available).
Rear brake	Ø 240 mm hydraulically operated disc brake controlled from LH handlebar lever; braking assisted by ABS system (where available).
Integral braking system	A hydraulic system allowing the rider to operate all three brake discs simultaneously from the pedal on the foot board; braking assisted by ABS system (where available).
Wheel rims type	Light alloy.
Front wheel rims	13" x 3.00
Rear rim	14" x 4.50
Front tyres	Tubeless 110/70 - 13" 48S
Rear tire	Tubeless 140/70 - 14" 68S
Front tyre pressure	2 bar
Rear tire pressure (with passenger)	2.4 (2.6) bar
Kerb weight	282 kg
Maximum weight limit	460 kg
Battery	12V - 12Ah

Engine Data

ENGINE SPECIFICATIONS

Specification	Desc./Quantity
Type	Single cylinder 4-stroke
Engine capacity	493 cm³
Bore x Stroke	94 x 71 mm
Compression ratio	11,5 ± 0,5 : 1
Idle engine speed	1.650 ± 100 rpm
Timing system	Four valves, single overhead camshaft, chain-driven.
Valve clearance (cold engine)	Intake: 0.15 mm Exhaust: 0.15 mm
Max. power	32 kW at 7,750 rpm
MAX torque	47.5 Nm at 5,750 rpm
Transmission	CVT expandable pulley continuously variable transmission with torque server, V-belt, self-ventilating dry automatic centrifugal clutch and transmission housing with forced-circulation air cooling. Electrically operated reverse gear.
Final drive reduction gear	Gear reduction unit in oil bath.
Lubrication	Engine lubrication with lobe pump (inside crankcase), chain-driven, with double filter: mesh and paper.
Cooling	Forced coolant circulation system.
Starting	Electric
Ignition	High efficiency inductive electronics integrated with injection, variable advance, separate H.V. coil and double spark plug.
Ignition advance	Three-dimensional map managed by control unit
Spark plug	NGK MR7BI-8 / MR8BI-8
Electrode gap	0.7-0.9 mm
Power supply	Electronic injection with electric fuel pump.
Fuel	Unleaded gasoline E10 (95 R.O.N.)
Fuel pressure	3.5 bar
Exhaust silencer	Absorption type with catalytic converter and lambda probe.
Emissions compliance	EURO 5

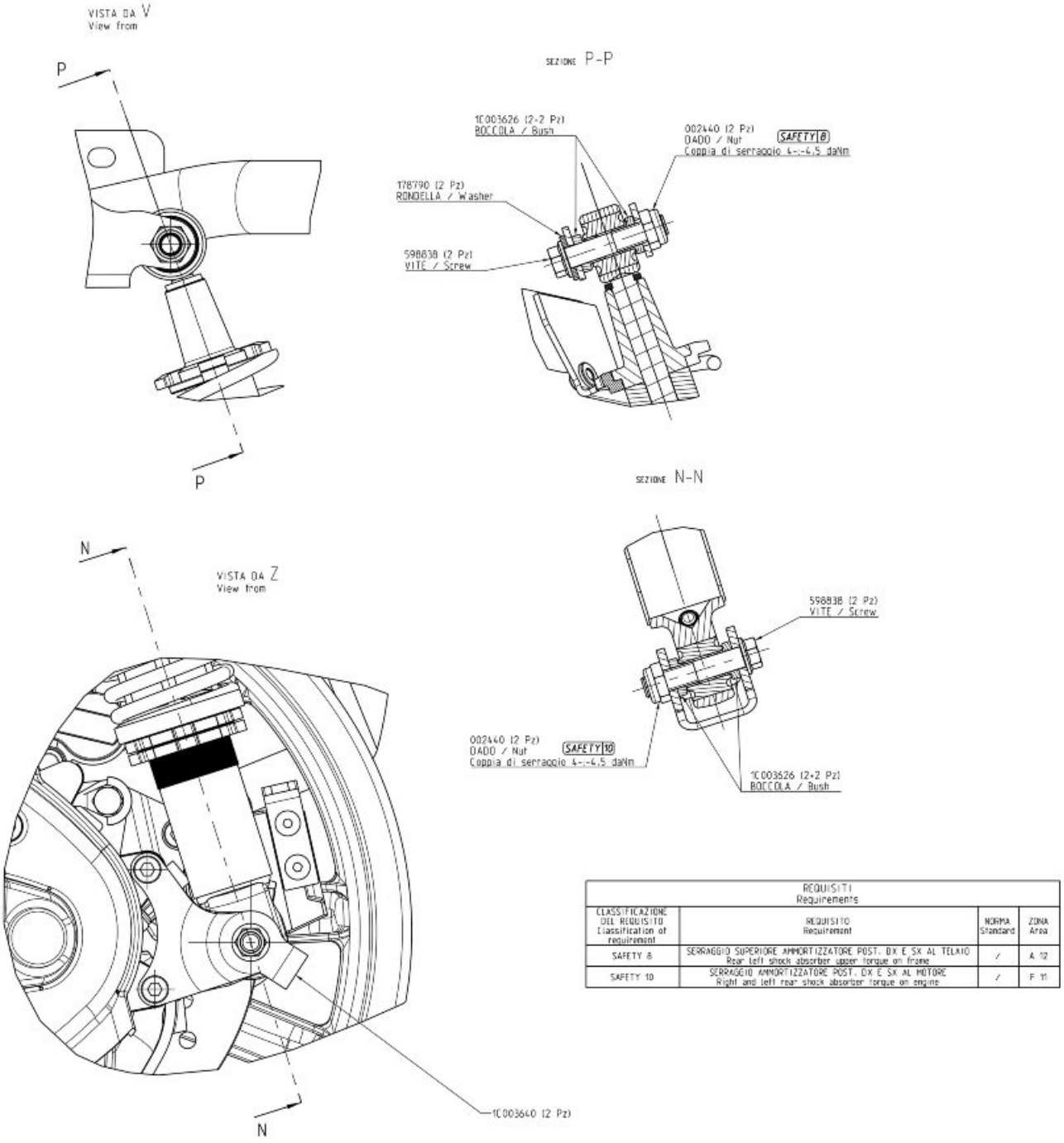
Electrical system

ELECTRICAL SYSTEM

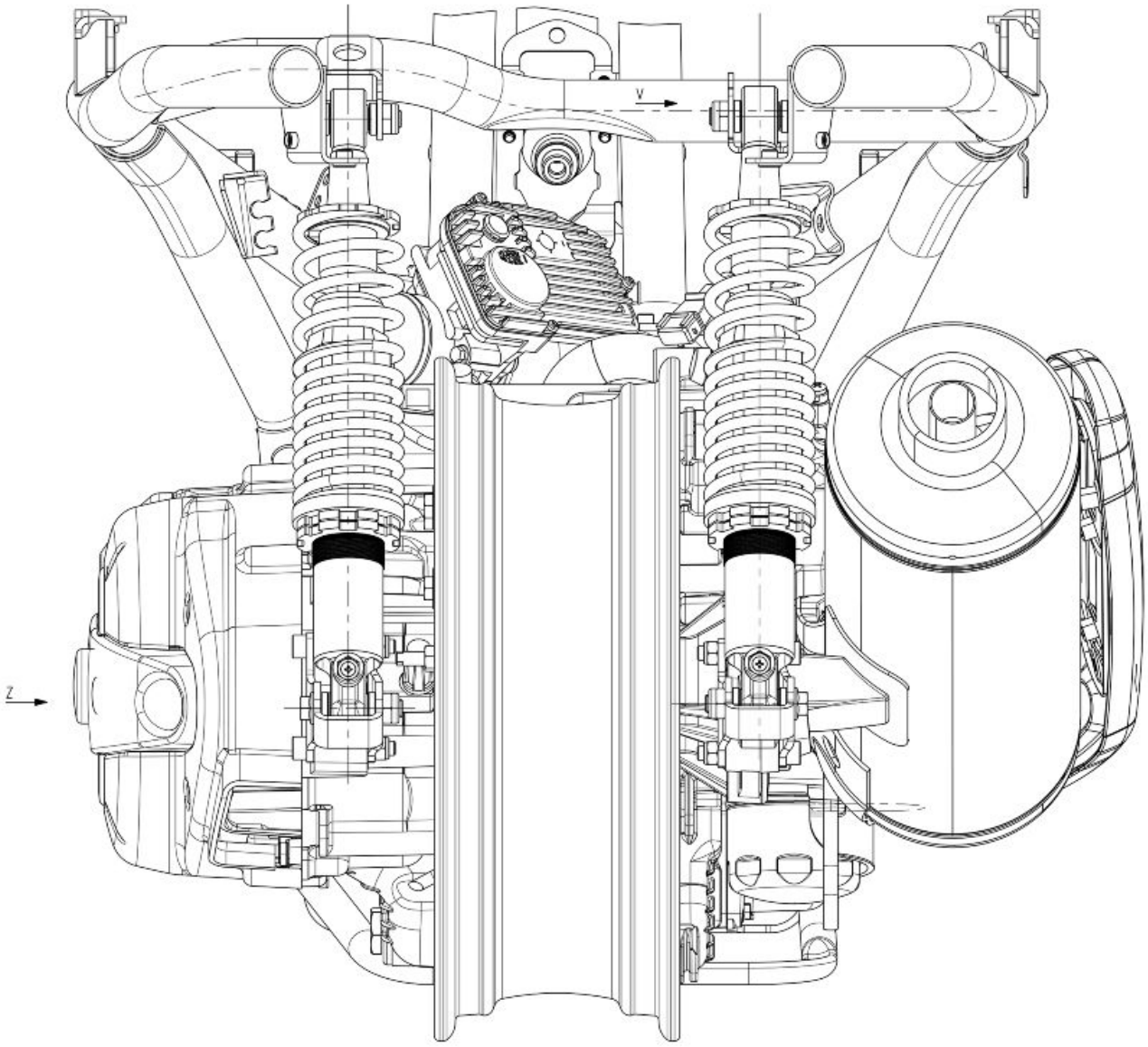
Specification	Desc./Quantity
Starting	Electric
Ignition	High efficiency inductive electronics integrated with injection, variable advance, separate H.V. coil and double spark plug.
Ignition advance	Three-dimensional map managed by control unit
Battery	12V - 12Ah
Spark plug	NGK MR7BI-8 / MR8BI-8
Electrode gap	0.7-0.9 mm

Tightening Torques

SUSPENSIONS



REQUISITI Requirements			
CLASSIFICAZIONE DEL REQUISITO Classification of requirement	REQUISITO Requirement	NORMA Standard	ZONA Area
SAFETY 8	SERRAGGIO SUPERIORE AMMORTIZZATORE POST. DX E SX AL TELAIO Rear left shock absorber upper torque on frame	/	A 12
SAFETY 10	SERRAGGIO AMMORTIZZATORE POST. DX E SX AL MOTORE Right and left rear shock absorber torque on engine	/	F 11



FRONT SUSPENSION

Name	Torque in Nm
Fixing nuts for constant-velocity universal joints	18 - 20 Nm (13 -15 lb*ft)
Steering arm pin nut	20 - 25 Nm (15 - 18 lb*ft)
Lower shock absorber clamp	19 - 26 Nm (14 -19 lb*ft)
Shock absorber upper clamp	19 - 29 Nm (14 -21 lb*ft)
Clamp for sliding stem locking device	6.5 - 10.5 Nm (4.8 -8 lb*ft)
Fastening that secures the electric motor to the anti-roll device	11 - 13 Nm (8 -10 lb*ft)
fastening that secures the pump pin to the anti-roll device	11 - 13 Nm (8 -10 lb*ft)
Fastening that secures the pump to the anti-roll device	11 - 13 Nm (8 -10 lb*ft)
Fastening that secures the potentiometer to the anti-roll device	8 - 10 Nm (5.9 - 7 lb*ft)
Fastening that secures the sensor to the anti-roll device	2.5 - 2.9 Nm (1.8 -2.1 lb*ft)
Side column lower ferrule	12 - 15 Nm (9 -11 lb*ft)
Side column upper ferrule	20 - 24 Nm (15 -18 lb*ft)
Pressure switch to the distributor	18 - 20 Nm (13 -15 lb*ft)
Anti-roll device pump fitting	20 - 25 Nm (15 - 18 lb*ft)
Suspension lock calliper pipe fitting on side steering pipe	25 - 28 Nm (18 - 21 lb*ft)
Slew rings retaining bracket tube terminals	7 - 11 Nm (5.2 -8 lb*ft)

Name	Torque in Nm
Roll lock calliper control transmission	10 Nm
Screw fixing sliding stem to shock absorber	45 - 50 Nm (33 -37 lb*ft)
Arm coupling screws	45 - 50 Nm (33 -37 lb*ft)
Screws fastening the arms to the side columns	45 - 50 Nm (33 -37 lb*ft)
Screws used to fasten the arms to the central column	45 - 50 Nm (33 -37 lb*ft)
Linkage arms coupling flange fastening screws	20 - 25 Nm (15 - 18 lb*ft)
Roll callipers fastening screws	20 - 25 Nm (15 - 18 lb*ft)
Front wheel fastening screws	19 - 24 Nm (14 -18 lb*ft)
Roll brake disc sector fastening screws	20 - 25 Nm (15 - 18 lb*ft)

REAR SUSPENSION

Name	Torque in Nm
Rear wheel axle	104 - 126 Nm (77 -93 lb*ft)
Lower shock absorber clamp	40 - 45 Nm
Shock absorber upper clamp	40 - 45 Nm
Shock-absorber/guard coupling bracket	20 - 27 Nm (15 -18 lb*ft)

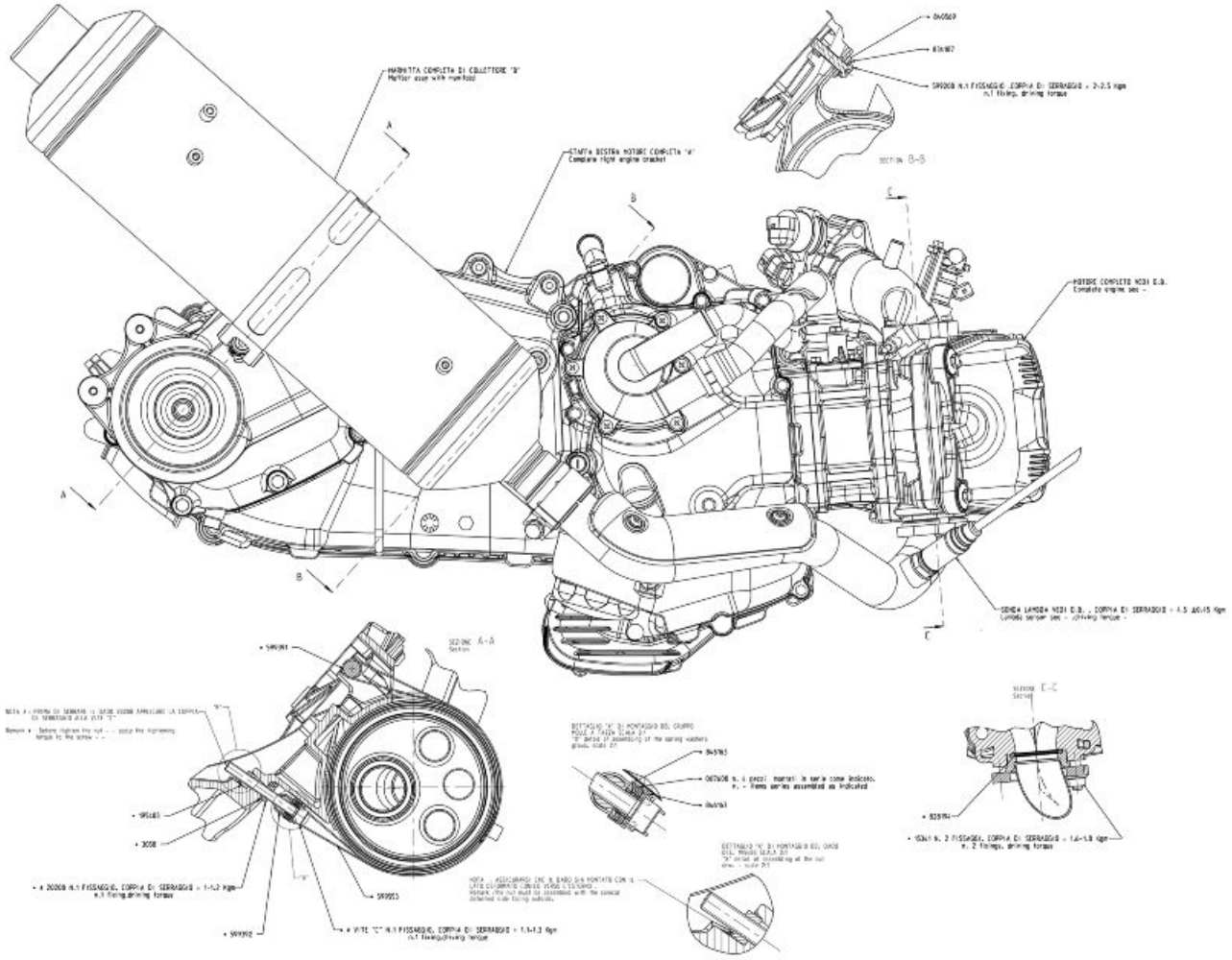
STEERING

Name	Torque in Nm
Lower steering ferrule (central column)	10 - 12 Nm (7 -9 lb*ft)
Upper steering ferrule (central column)	32.5 - 40 Nm (24 -30 lb*ft)
Handlebar fixing screw	50 - 55 Nm (37 -41 lb*ft)
Screws used to fasten the control unit jumper cables to the handlebars	7 - 10 Nm (5.2 -7 lb*ft)

CHASSIS

Name	Torque in Nm
Swing arm regulator bushing	5 - 7 Nm (3.7 -5.2 lb*ft)
Engine arm - chassis arm pin	32.5 - 40 Nm (24 -30 lb*ft)
Swing arm regulator bushing nut	54 - 60 Nm (40 -44 lb*ft)
Engine-swinging arm bolt	98 - 118 Nm (72 -87 lb*ft)
Frame-swinging arm bolt	54 - 60 Nm (40 -44 lb*ft)
Central stand bolt	31 - 39 Nm (23 -29 lb*ft)

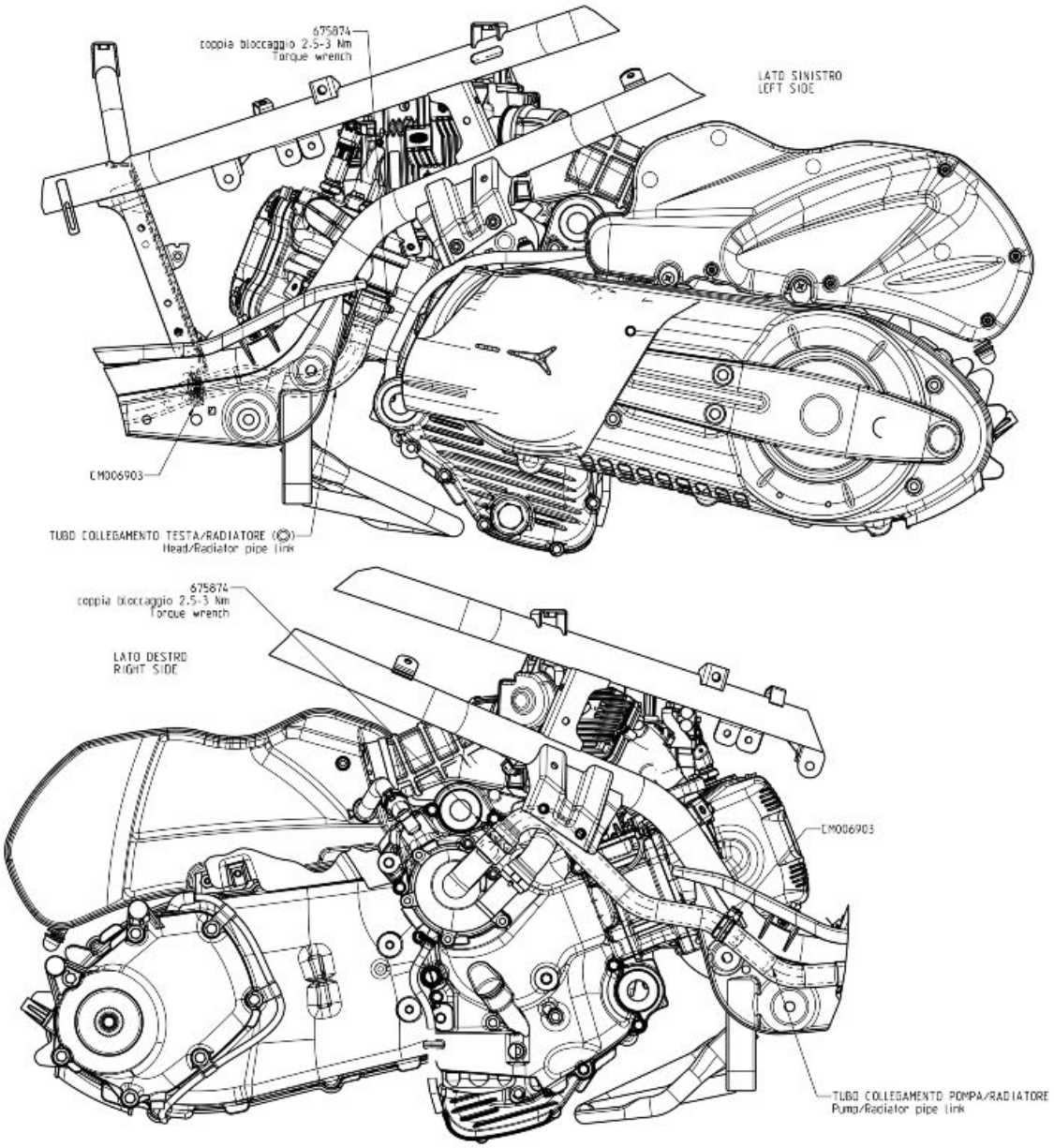
SILENCER



SILENCER

Name	Torque in Nm
Manifold/silencer tightening clamp	16 - 18 Nm (12 -13 lb*ft)
Manifold/silencer joint tightening torque	12 - 13 Nm (9 -10 lb*ft)
Lambda probe tightening on exhaust manifold	40 - 50 Nm (30 -37 lb*ft)
Screw used to fasten silencer to supporting arm	20 - 25 Nm (15 - 18 lb*ft)
Silencer heat guard fixing screw	4 - 5 Nm (3 -3.7 lb*ft)
Silencer support band nut	9,8 ÷ 11.8 Nm
Silencer support band screw	10.8-12.7 Nm

COOLING SYSTEM



NOTE

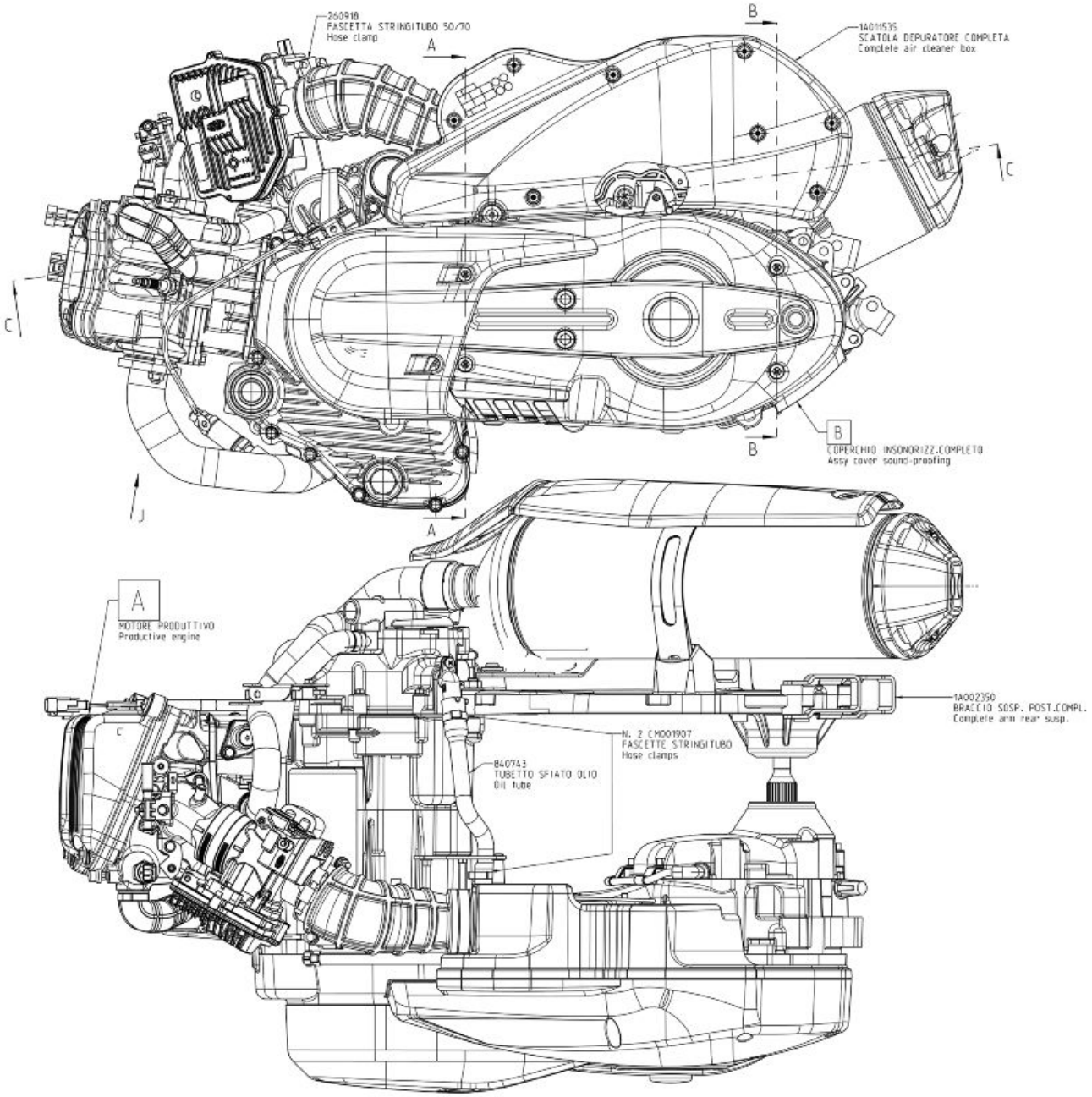
- PRIMA DEL RIEMPIMENTO COLLAUDARE IL CIRCUITO ALLA PRESSIONE DI 1.2 bar E DOPO 20 sec. LA PRESSIONE DEVE RISULTARE > 1.1 bar.
- GARANTIRE IL COMPLETO RIEMPIMENTO
- RIEMPIRE IL CIRCUITO CON FLUIDO ANTIGELO NORMA 2966

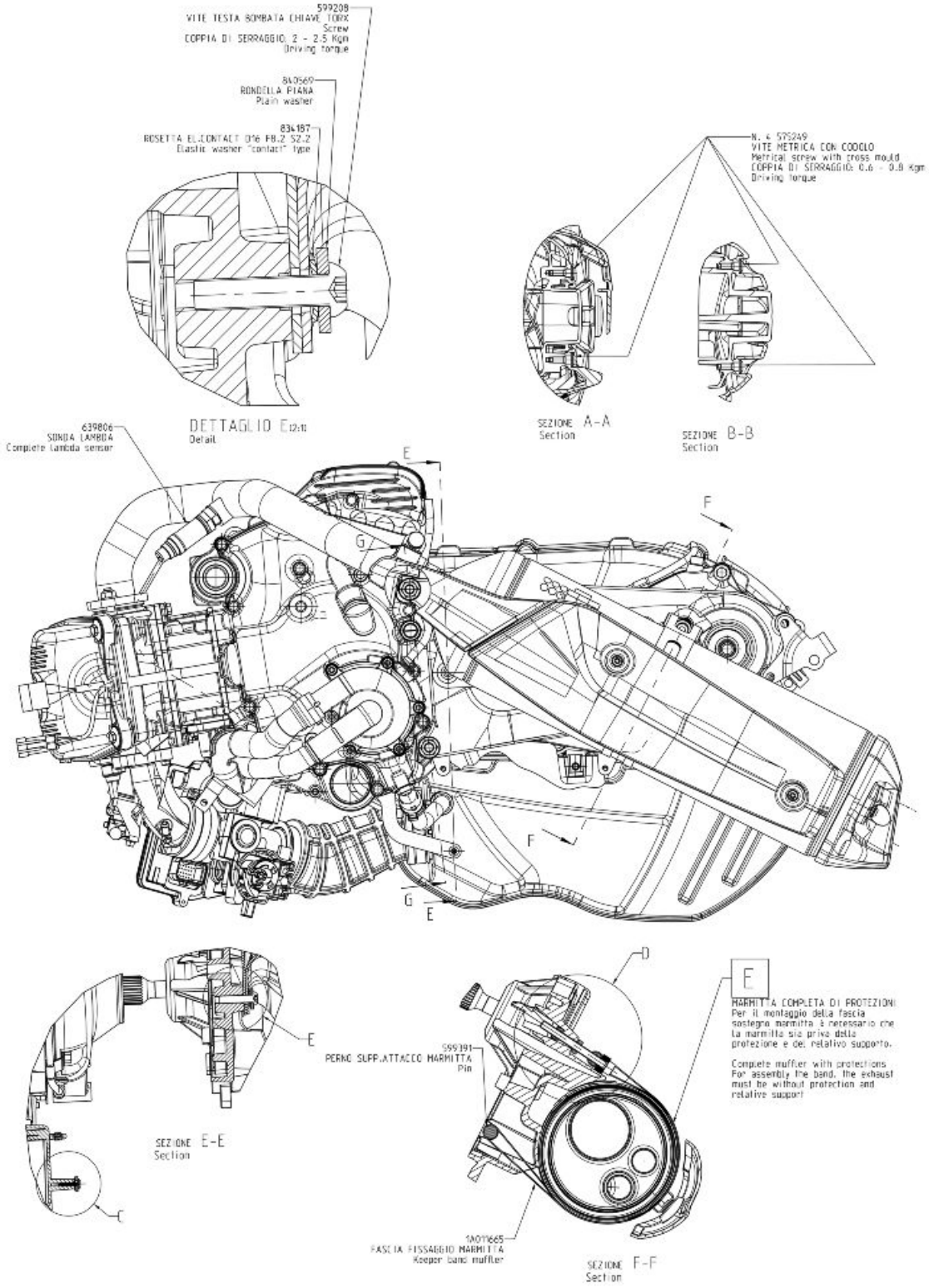
- Before filling it up test the circuit at pressure of 1.2 bar and after 20 sec. the pressure must result > 1.1 bar.
- Guarantee the complete filling of circuit
- Fill the circuit with antifreeze fluid as standard 2966

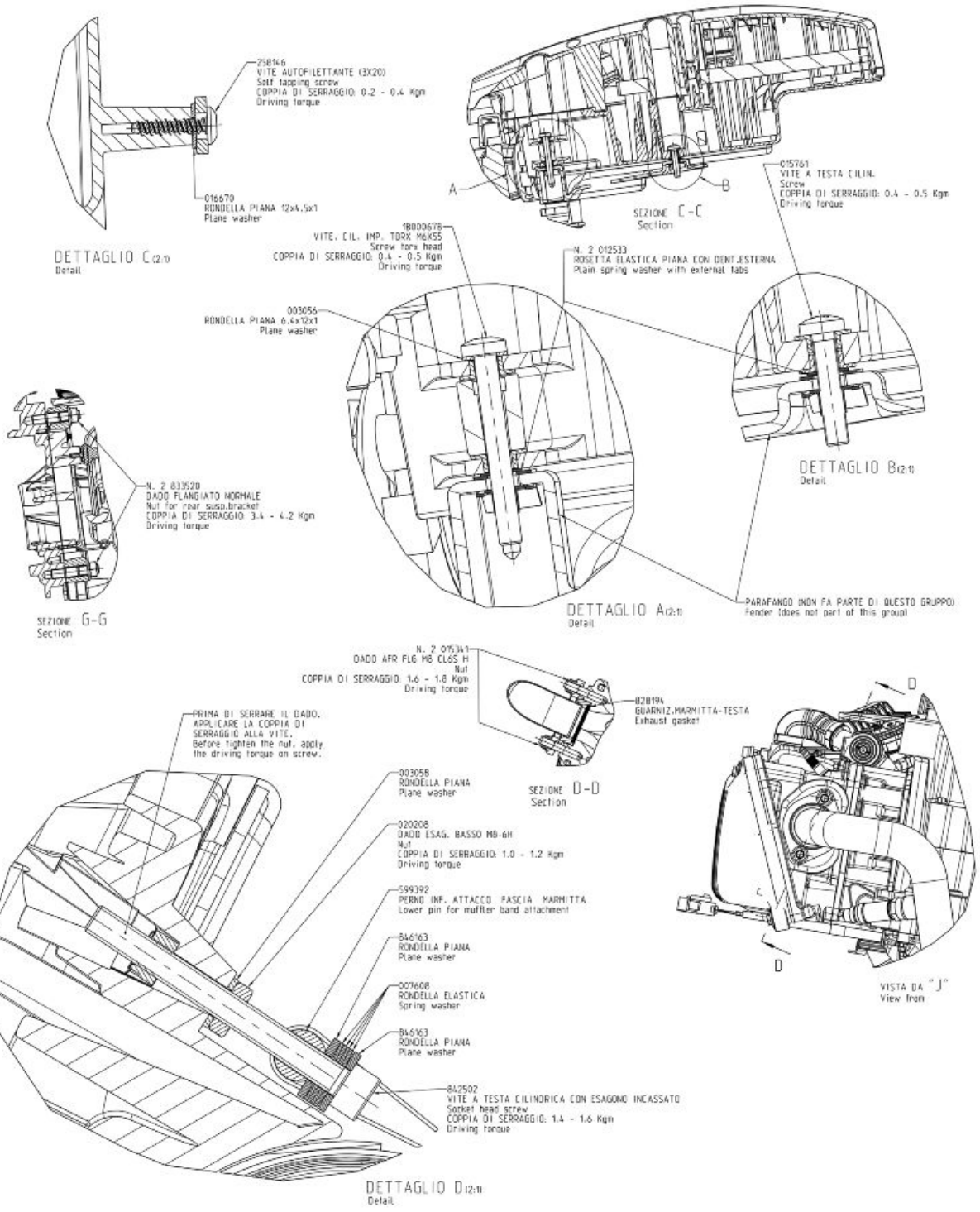
COOLING SYSTEM

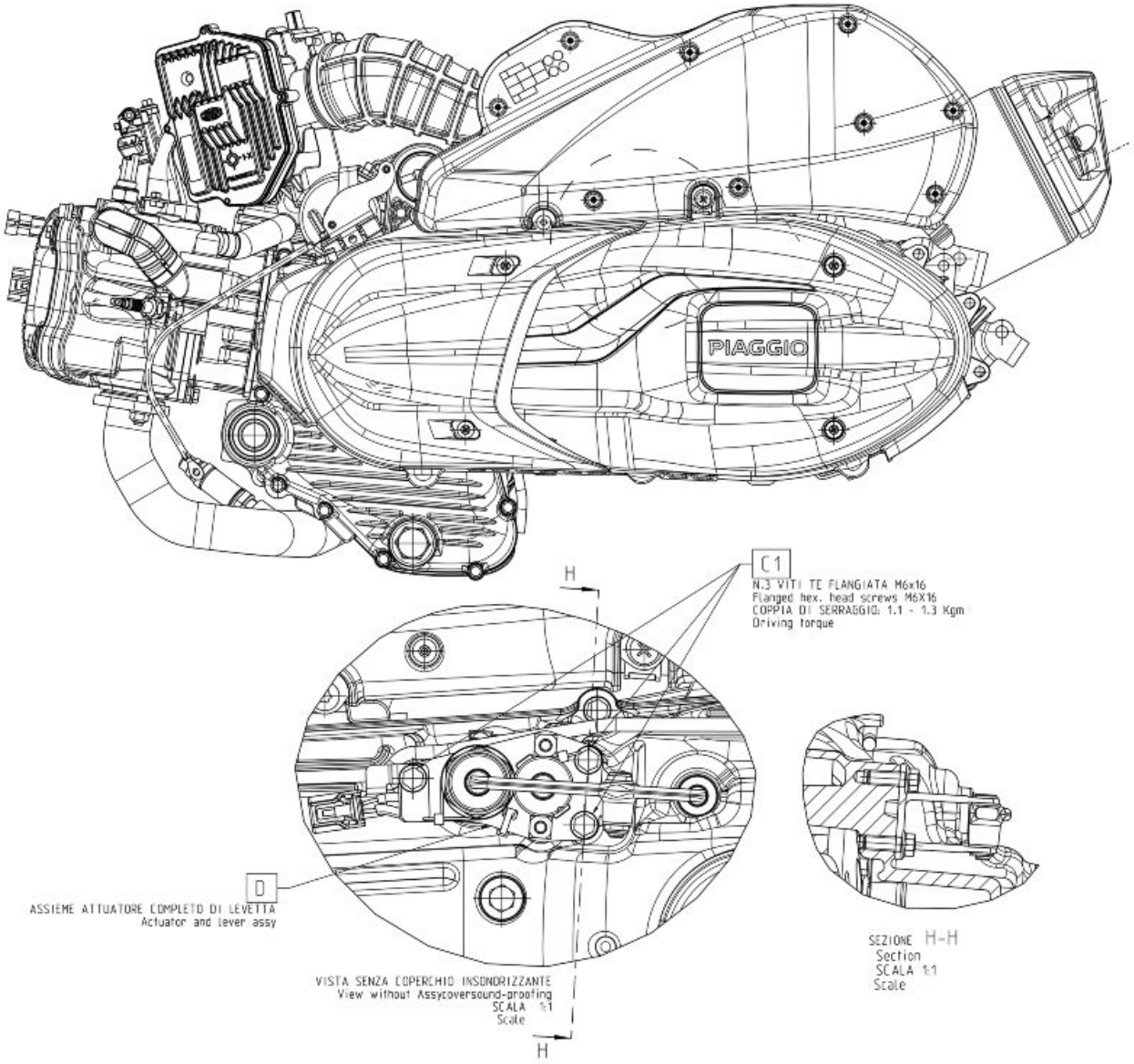
Name	Torque in Nm
Pump/radiator connecting pipe clamp	2.5 ÷ 3 Nm
Head/radiator connecting pipe clamp	2.5 ÷ 3 Nm
Water pump impeller	4 - 5 Nm (3 -3.7 lb*ft)
Bleeder screw	3 Nm (2.2 lb*ft)
Water pump cover screws	3 - 4 Nm (2.2 -3 lb*ft)
Thermostat cover screws	3 - 4 Nm (2.2 -3 lb*ft)

ENGINE


260918
FASCETTA STRINGITUBO 50/70
Hose clamp
1A011535
SCATOLA DEPURATORE COMPLETA
Complete air cleaner box
B
COPERCHIO INSONORIZZ.COMPLETO
Assy cover sound-proofing
A
MOTORE PRODUTTIVO
Productive engine
1A002350
BRACCIO SOSP. POST.COMPL.
Complete arm rear susp.
N. 2 CM001907
FASCETTE STRINGITUBO
Hose clamps
840743
TUBETTO SFIATO OLIO
Oil tube


599208
VITE TESTA BOMBATA CHIAVE TORX
Screw
COPPIA DI SERRAGGIO: 2 - 2.5 Kgm
Driving torque
840569
RONDELLA PIANA
Plain washer
834187
ROSETTA EL.CONTACT D16 FB.2 SZ.2
Elastic washer "contact" type
N. 4 595249
VITE METRICA CON CODOLO
Metrical screw with cross mould
COPPIA DI SERRAGGIO: 0.6 - 0.8 Kgm
Driving torque
DETTAGLIO E 12:1
Detail
SEZIONE A-A
Section
SEZIONE B-B
Section
639806
SONDA LAMBDA
Complete lambda sensor
E
F
G
F
G
E
E
SEZIONE E-E
Section
D
599391
PERNO SUPP.ATTACCO MARMITTA
Pin
E
MARMITTA COMPLETA DI PROTEZIONI
Per il montaggio della fascia sostegno marmitta è necessario che la marmitta sia priva della protezione e del relativo supporto.
Complete muffler with protections
For assembly the band, the exhaust must be without protection and relative support
SA011665
FASCIA FISSAGGIO MARMITTA
Keeper band muffler
SEZIONE F-F
Section


258146
VITE AUTOFILETTANTE (3X20)
Self tapping screw
COPPIA DI SERRAGGIO: 0.2 - 0.4 Kgm
Driving torque
016670
RONDELLA PIANA 12x4.5x1
Plane washer
DETTAGLIO C (2:1)
Detail
A
B
SEZIONE C-C
Section
015761
VITE A TESTA CILIN.
Screw
COPPIA DI SERRAGGIO: 0.4 - 0.5 Kgm
Driving torque
1B000678
VITE. CIL. IMP. TORX M6X55
Screw torx head
COPPIA DI SERRAGGIO: 0.4 - 0.5 Kgm
Driving torque
N. 2 012533
ROSETTA ELASTICA PIANA CON DENT.ESTERNA
Plain spring washer with external tabs
003056
RONDELLA PIANA 6.4x12x1
Plane washer
DETTAGLIO B (2:1)
Detail
N. 2 833520
DADO FLANGIATO NORMALE
Nut for rear susp.bracket
COPPIA DI SERRAGGIO: 3.4 - 4.2 Kgm
Driving torque
SEZIONE G-G
Section
DETTAGLIO A (2:1)
Detail
PARAFANGO (NON FA PARTE DI QUESTO GRUPPO)
Fender (does not part of this group)
N. 2 075341
DADO AFR FLG M8 CL6S H
Nut
COPPIA DI SERRAGGIO: 1.6 - 1.8 Kgm
Driving torque
82B19A
GUARNIZ.MARMITTA-TESTA
Exhaust gasket
SEZIONE D-D
Section
D
C
D
VISTA DA "J"
View from
PRIMA DI SERRARE IL DADO,
APPLICARE LA COPPIA DI
SERRAGGIO ALLA VITE.
Before tighten the nut, apply
the driving torque on screw.
003058
RONDELLA PIANA
Plane washer
020208
DADO ESAG. BASSO M8-6H
Nut
COPPIA DI SERRAGGIO: 1.0 - 1.2 Kgm
Driving torque
599392
PERNO INF. ATTACCO FASCIA MARMITTA
Lower pin for muffler band attachment
846163
RONDELLA PIANA
Plane washer
007608
RONDELLA ELASTICA
Spring washer
846163
RONDELLA PIANA
Plane washer
842502
VITE A TESTA CILINDRICA CON ESAGONO INCASSATO
Socket head screw
COPPIA DI SERRAGGIO: 1.4 - 1.6 Kgm
Driving torque
DETTAGLIO D (2:1)
Detail



LUBRICATION

Name	Torque in Nm
Oil pump cover screws	0.7 - 0.9 Nm (0.52 -0.66 lb*ft)
Screws fixing oil pump to the crankcase	5 - 6 Nm (3.7 -4.4 lb*ft)

HEAD/ENGINE BLOCK/PISTON ASSEMBLY AND TIMING SYSTEM

Name	Torque in Nm
Spark plug	12 - 14 Nm (9 -10 lb*ft)
Head fixing stud bolts	10 Nm + 90° + 90° (5.2 lb*ft + 90° + 90°)
Head fastening nuts	10 - 12 Nm (7 -9 lb*ft)
Exhaust/intake head fastening nuts	10 - 12 Nm (7 -9 lb*ft)
Cylinder head lubrication nozzle	5 - 7 Nm (3.7 -5.2 lb*ft)
Coolant temperature sensor	10 - 12 Nm (7 -9 lb*ft)
Lambda probe on exhaust manifold	10 - 12 Nm (7 -9 lb*ft)
Injector fastening screw	3 - 4 Nm (2.2 -3 lb*ft)
Counterweight screw	7 - 8.5 Nm (5.2 -6.3 lb*ft)

Name	Torque in Nm
Tensioner show fastening screw	10 - 14 Nm (7 -10 lb*ft)
Timing sensor fastening screw	3 - 4 Nm (2.2 -3 lb*ft)
Valve lifter weight stop bell fastening screws	30 - 35 Nm (22 -26 lb*ft)
Inlet manifold screws	11 - 13 Nm (8 -10 lb*ft)
Tappet cover fastening screws	7 - 9 Nm (5.2 -6.6 lb*ft)
Throttle body fastening screws	11 - 13 Nm (8 -10 lb*ft)
Cylinder head fastening screws	10 - 12 Nm (7 -9 lb*ft)
Camshaft retaining bracket screws	4 - 6 Nm (3 -4.4 lb*ft)
Tensioner screw	5 - 6 Nm (3.7 -4.4 lb*ft)
Tensioner fastening screws	11 - 13 Nm (8 -10 lb*ft)

TRANSMISSION COVER

Name	Torque in Nm
Driven pulley nut	92 - 100 Nm (68 -74 lb*ft)
Driver pulley nut	160 - 175 Nm (118 -129 lb*ft)
Baffle roller screw	16.7 - 19.6 Nm (12 -14 lb*ft)
M8 transmission cover fastenings	23 - 26 Nm (17 -19 lb*ft)
M6 transmission cover fastenings	11 - 13 Nm (8 -10 lb*ft)
Baffle roller fastening	17 - 19 Nm (13 -14 lb*ft)
Clutch ferrule	65 - 75 Nm (48 -55 lb*ft)
Air duct screws	11 - 12 Nm (8 -9 lb*ft)
Water pump cover screws	3 - 4 Nm (2.2 -3 lb*ft)
External transmission cover screws	7 - 9 Nm (5.2 -6.6 lb*ft)
Flywheel cover screws	11 - 13 Nm (8 -10 lb*ft)

FLYWHEEL COVER

Name	Torque in Nm
Chain guide shoe fastening screws	3 - 4 Nm (2.2 -3 lb*ft)
Flywheel fixing nut	115 - 125 Nm (85 -92 lb*ft)
Stator fastenings	8 - 10 Nm (5.9 - 7 lb*ft)
Blow-by recovery duct fastening screws	3 - 4 Nm (2.2 -3 lb*ft)
Screws used to secure the freewheel to the flywheel	13 - 15 Nm (10 -11 lb*ft)
Stator wiring guide bracket screws	3 - 4 Nm (2.2 -3 lb*ft)
Support screws with bulkhead	0.3 - 0.4 Nm (0.22 -0.30 lb*ft)
Minimum oil pressure sensor	12 - 14 Nm (9 -10 lb*ft)
Water pump impeller	4 - 5 Nm (3 -3.7 lb*ft)

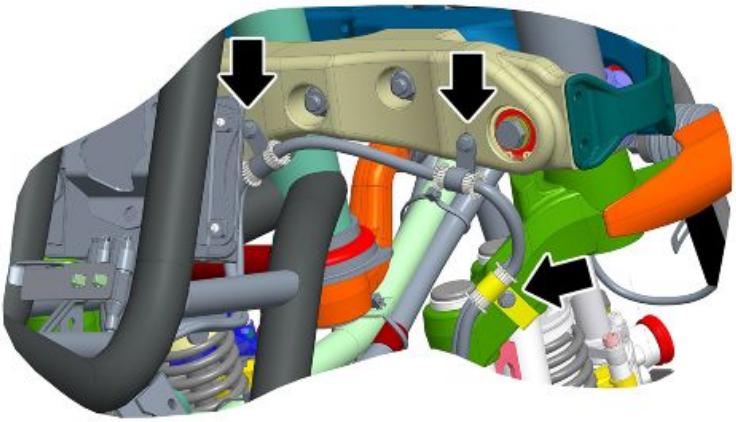
CRANKSHAFT AND CASE

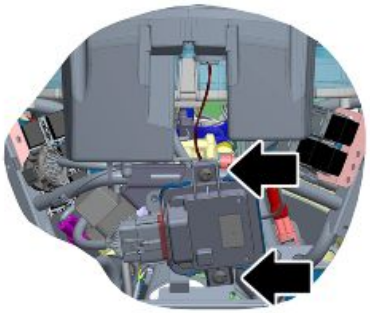
Name	Torque in Nm
Counter-shaft fastening nut	25 - 29 Nm (18 -21 lb*ft)
Engine oil filter	12 - 16 Nm (9 -12 lb*ft)
Engine oil drainage plug	24 - 30 Nm (18 -22 lb*ft)
Engine-crankcase coupling screws	11 - 13 Nm (8 -10 lb*ft)
Oil pump screws	5 - 6 Nm (3.7 -4.4 lb*ft)
Crankshaft gearwheel screws	10 - 12 Nm (7 -9 lb*ft)
Oil pump compartment closing bulkhead screw	8 - 10 Nm (5.9 - 7 lb*ft)

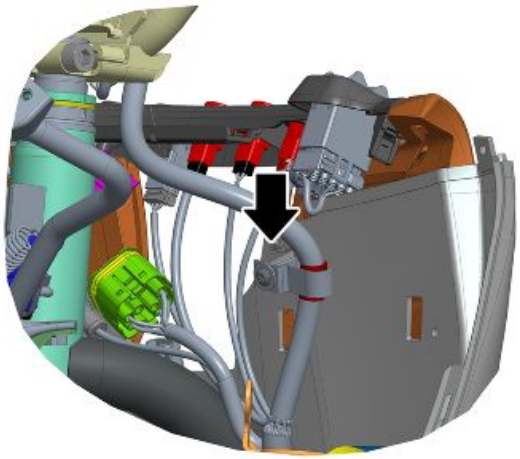
REVERSE GEAR SYSTEM

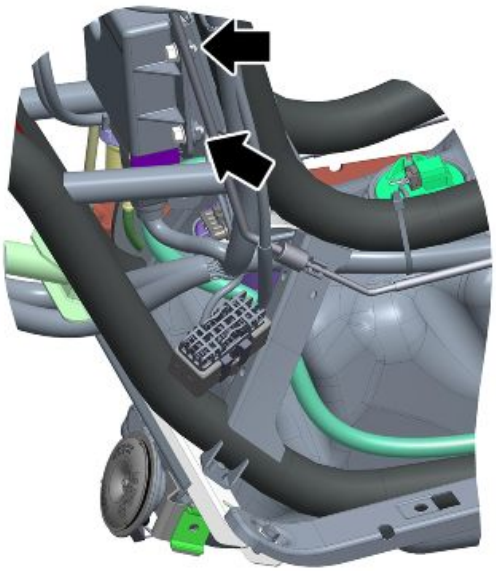
Name	Torque in Nm
Reverse gear control bushing ring nut	66-74 Nm (49-55 lb*ft)
Reverse gear system oil relief screw	15-17 Nm (11-13 lb*ft)
Reverse gear system cover screws	11 - 13 Nm (8 -10 lb*ft)
Reverse gear motor fastening screws	11 - 13 Nm (8 -10 lb*ft)

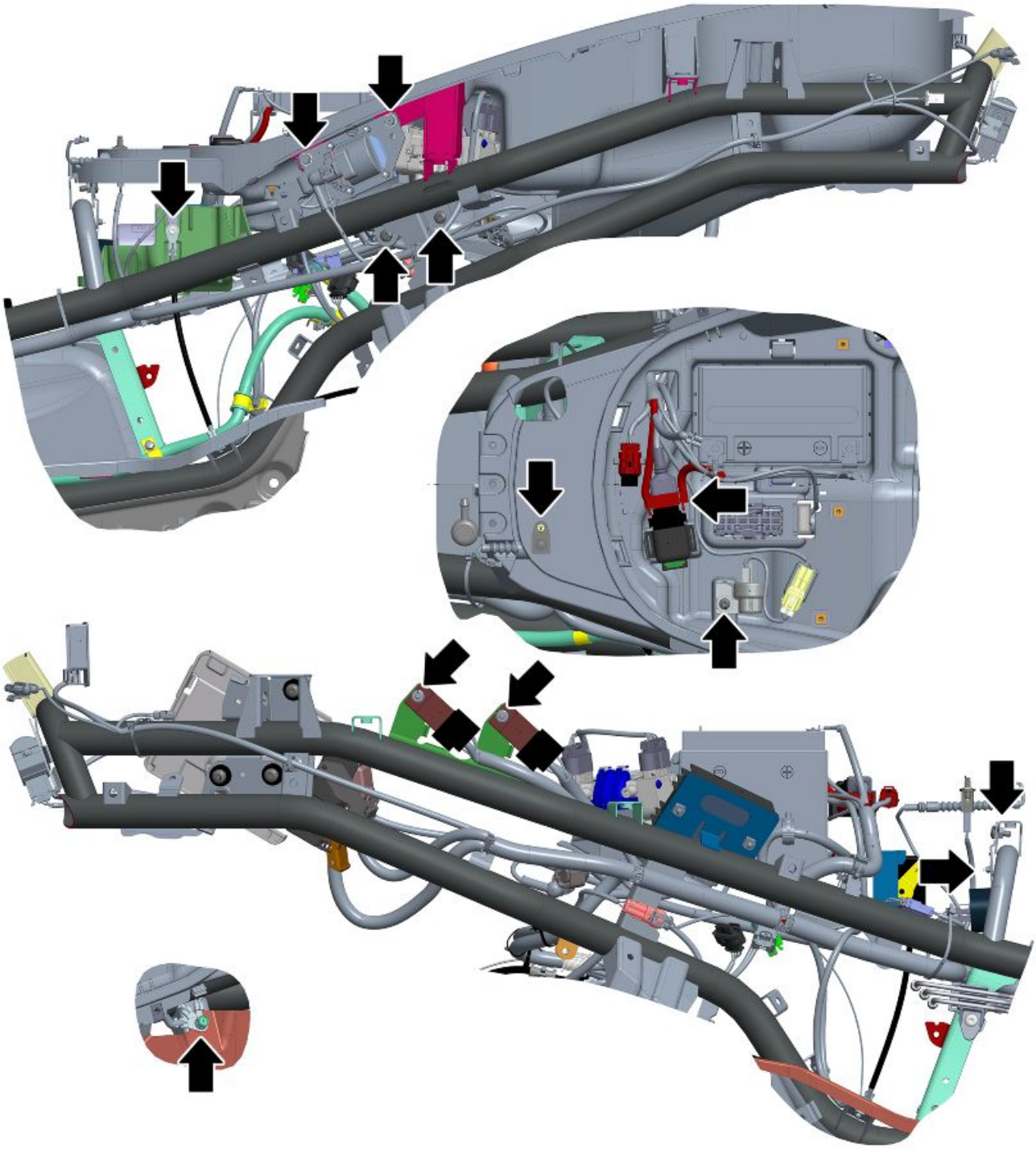
ELECTRICAL SYSTEM

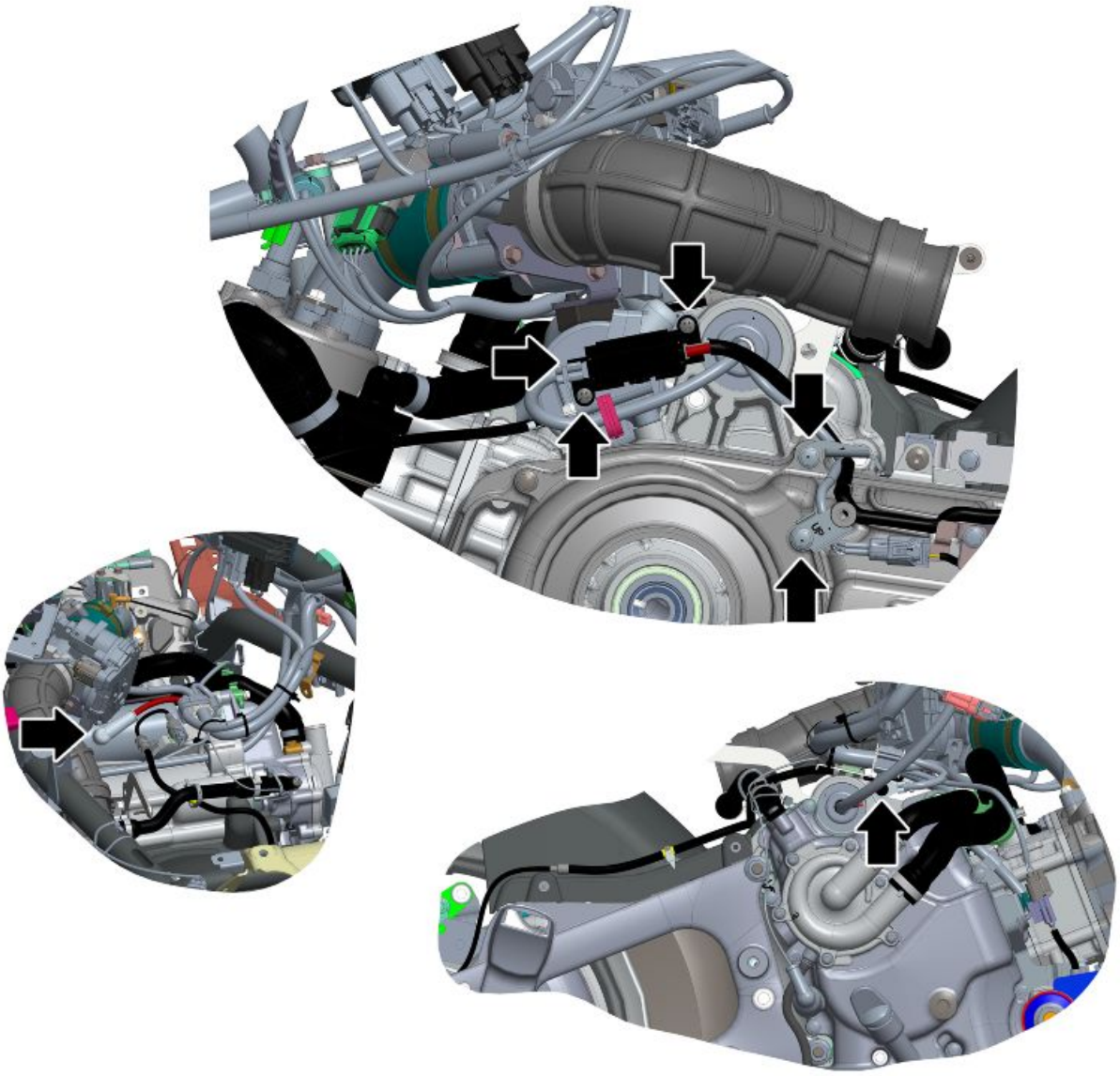












ELECTRICAL SYSTEM

Name	Torque in Nm
Front wheels sensors cable unit metal clamps	6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)
PMP3 control unit	6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)
Handlebar cables unit metal clamp	1 ÷ 1,7 Nm (0.7 ÷ 1.3 lbf*ft)
Parking control ECU	6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)
H.V. coil.	6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)
Control unit anchoring bracket	6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)
ABS control unit ground	7,5 ÷ 9,5 Nm (5.5 ÷ 7 lbf*ft)
Helmet compartment light switch	1 ÷ 1,7 Nm (0.7 ÷ 1.3 lbf*ft)
Fall sensor	1 ÷ 1,7 Nm (0.7 ÷ 1.3 lbf*ft)
Starter relay positive cables	4 - 6 Nm (3 -4.4 lb*ft)
Reverse gear relays	6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)
Reverse gear buzzer support bracket	6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)
Reverse gear buzzer	1,5 ÷ 2,5 Nm (1.1 ÷ 1.8 lbf*ft)
Frame ground	7,5 ÷ 9,5 Nm (5.5 ÷ 7 lbf*ft)
Reverse gear cable unit upper bracket	11 ÷ 13 Nm (8.1 ÷ 9.6 lbf*ft)
Reverse gear cable unit lower bracket	6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)
Shunt connection support	3 ÷ 3,5 Nm (2.2 ÷ 2.6 lbf*ft)
Shunt connection	4 - 6 Nm (3 -4.4 lb*ft)

Name	Torque in Nm
Starter motor positive cable	6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)
Engine ground lead	7,5 ÷ 9,5 Nm (5.5 ÷ 7 lbf*ft)

TRANSMISSIONS AND BRAKES

FRONT BRAKE

Name	Torque in Nm
Brake calliper pipe fitting on side steering pipe	25 - 28 Nm (18 - 21 lb*ft)
Calliper-pipe fitting	20 - 25 Nm (15 - 18 lb*ft)
Brake pump - pipe fitting	20 - 25 Nm
Callipers fitting screw	22 - 27 Nm (16 - 20 lb*ft)
Screw tightening calliper to support	20 - 25 Nm (15 - 18 lb*ft)
Oil bleed screw	8 - 12 Nm (5.9 - 9 lb*ft)
Front brake disc screws	8 - 10 Nm (5.9 - 7 lb*ft)

REAR BRAKE

Name	Torque in Nm
Parking brake transmission adjustment nut	10 Nm
Rear brake calliper-pipe fitting	20 - 25 Nm (15 - 18 lb*ft)
Brake pump - pipe fitting	20 - 25 Nm
Rigid / flexible pipe fitting	13 - 18 Nm (10 - 13 lb*ft)
Rear brake disc screws (°)	5 - 6.5 Nm (3.7 - 4.8 lb*ft)
Rear brake calliper fixing screws	41.5 - 51.5 Nm (31 - 38 lb*ft)
Pipe support bracket fastening screws	6 to 8 Nm
Rear brake calliper tube fixing screws	6 - 10 Nm
Parking brake - Screw used to fasten callipers to the support (°)	24 - 27 Nm (18 - 20 lb*ft)

(°) Apply LOCTITE 243 medium strength thread locker.

INTEGRAL BRAKE PEDAL

Name	Torque in Nm
Brake pump - pipe fitting	20 - 25 Nm
Screw fastening the brake pedal to the chassis	20 - 25 Nm
Screw fastening the integral brake fluid tank	1 - 1.7 Nm

ABS SYSTEM

Name	Torque in Nm
Pipe fittings - ABS control unit	19 - 21 Nm
Pipe fittings - ABS electronic brake force distribution	20 - 25 Nm
Screws used to fasten the ABS control unit to the support	6 - 10 Nm
ABS stiff piping support plate fastening screws	4 - 6 Nm
ABS control unit support fastening screws	6 - 10 Nm
ABS sensors fastening screws	6 - 10 Nm (4.4 -7 lb*ft)

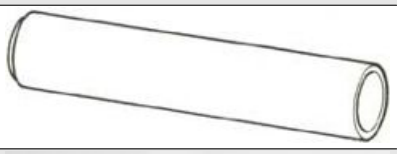
THROTTLE CONTROL TRANSMISSIONS

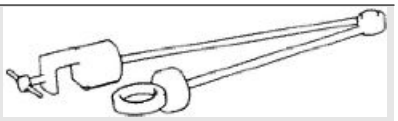
Name	Torque in Nm
Transmission adjustment nuts	5 - 6 Nm
Throttle body cover fastening screw	6 - 10 Nm

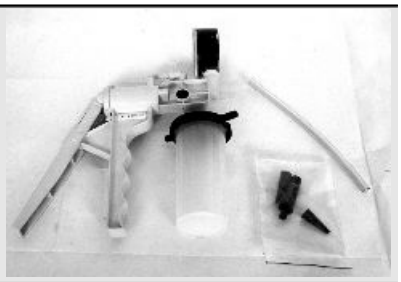
INDEX OF TOPICS

SPECIFIC TOOLS

Stores code	Description	
001330Y	Tool for fitting steering seats	
001467Y002	Driver for OD 73 mm bearing	
001467Y006	Pliers to extract 20 mm bearings	
001467Y007	Driver for OD 54-mm bearings	
001467Y008	Clamp to extract 17 mm ø bearings	
001467Y014	Calliper to extract ø 15-mm bearings	

Stores code	Description	
001467Y017	Bell for bearings, OD 39 mm	
001467Y031	Bell	
001467Y034	Calliper to extract ø 15-mm bearings	
001467Y035	Bearing housing, external ø 47 mm	
002465Y	Calliper for circlips	
006029Y	Punch for fitting steering bearing on the steering tube	
020004Y	Punch for removing steering bearings from headstock	

Stores code	Description	
020055Y	Wrench for steering tube ring nut	
020150Y	Air heater mounting	
020151Y	Air heater	
020193Y	Oil pressure gauge	
020201Y	Spacer bushing driving tube	
020262Y	Crankcase splitting plate	
020306Y	Punch valve seal rings fitting	

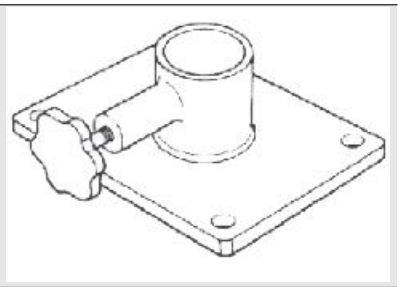
Stores code	Description	
020329Y	Mity-Vac vacuum pump	
020330Y	Stroboscopic light to check timing	
020331Y	Digital multimeter	
020335Y	Magnetic mounting for dial gauge	
020357Y	32 x 35-mm Adaptor	

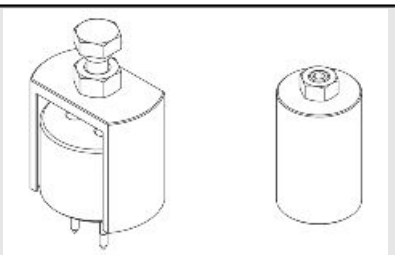
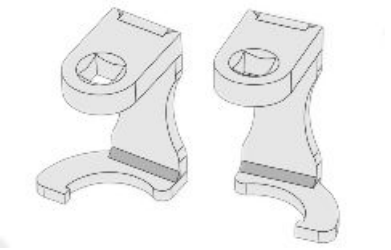
Stores code	Description	
020358Y	37 x 40 mm Adaptor	
020359S	42 x 47 mm Adaptor	
020360S	52 x 55 mm adaptor	
020364Y	25-mm guide	
020376Y	Adaptor handle	
020382Y012	bush (valve removing tool)	

Stores code	Description	
020412Y	15-mm guide	
020424Y	Driven pulley roller casing fitting punch	
020431Y	Valve oil seal extractor	
020434Y	Union for oil pressure measurement	
020439Y	17-mm guide	
020444Y	Tool for installing/removing clutch on/ from driven pulley	

Stores code	Description	
020456Y	Ø 24 mm adaptor	
020458Y	Puller for lower bearing on steering tube	
020459Y	Punch for fitting the bearing on the steering tube	
020467Y	Flywheel extractor	
020468Y	Piston fitting ring	
020470Y	Tool for fitting the pin locking stops	

Stores code	Description	
020472Y	Flywheel lock tool	
020475Y	Piston position checking tool	
020476Y	Stud bolt set	
020478Y	Punch for roller casing	
020479Y	Countershaft lock wrench	
020480Y	Fuel pressure measurement kit	

Stores code	Description	
020482Y	Engine support	
020483Y	30-mm guide	
020512Y	Piston fitting fork	
020527Y	Engine support base	
020604Y011	Fitting adapter	
020648Y	Single battery charger	
020565Y	Flywheel lock calliper spanner	

Stores code	Description	
020661Y	Water pump overall seal replacement kit	
020892y	Steering side headstock ring nut key	
020922Y	Diagnosis Tool	
020924Y	Bluetooth per Strumento di Diagnosi PADS	
021017Y	EOBD E5 diagnostics cable	
021021Y	Drive pulley lock	
021022Y	Driven pulley stop	

Stores code	Description	
021023Y	Ring nut locking wrench	
021024Y	Control bushing stopper wrench	

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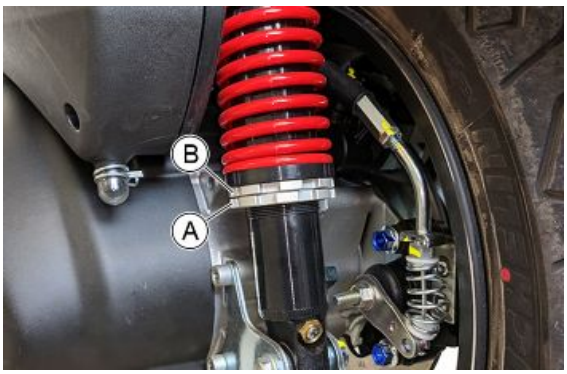
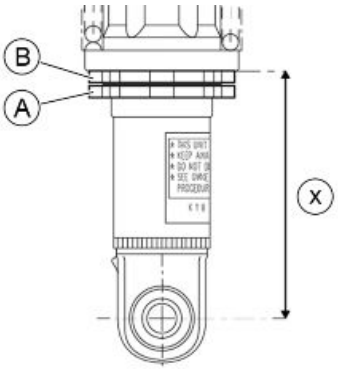
ADJUSTING THE REAR GAS SHOCK ABSORBERS





To adjust the rear gas shock absorbers pre-load proceed as follows:

1. Use the specific wrench for adjusting shock absorbers, inserting it from the bottom and connecting two teeth of the ring nut.

2. Unscrew the lower ring nut «**A**» spacing it a few millimetres from the top ring nut.

3. Turn the adjusting ring nut «**B**» until reaching the specified values.

4. Tighten the lower ring nut «**A**» bringing it in contact with the top ring nut and tighten it.

Specified values«**x**»

Position 1 minimum pre-load; rider only: **100 - 105 mm**

Position 2 maximum pre-load: rider, passenger and luggage: **119 mm**

CAUTION

RIDING THE VEHICLE WITH THE SPRING PRE-LOADING NOT CORRECTLY SET FOR THE RIDER AND POSSIBLE PASSENGER, COULD REDUCE THE COMFORT OF THE RIDE AND THE PRECISION OF THE STEERING.

WARNING

WE RECOMMEND WEARING GLOVES WHILE CARRYING OUT THIS OPERATION IN ORDER TO AVOID INJURIES.

WARNING

IT IS ABSOLUTELY FORBIDDEN TO ADJUST THE PRE-LOAD DIFFERENTLY ON THE TWO SHOCK ABSORBERS

CAUTION

CARRY OUT THE ADJUSTMENT WITH THE SILENCER COLD AND USING SUITABLE GLOVES AND PROTECTIVE CLOTHING.

N.B.

THE TWO TEETH ON THE WRENCH ALLOW YOU TO USE IT FOR EACH POSITION INDICATED IN THE FIGURE, IN BOTH DIRECTIONS.

SERVICE ICON RESET

When switching to «**ON**», immediately after the ignition check, if there are less than 300 km (187.5 miles) to the next scheduled service, the corresponding icon flashes for 5 seconds. Once the service mileage has been reached, the icon remains steadily on until it is reset. The icon reset is carried out by pressing the button «**SET**» for more than 10 seconds when switching to «**ON**»: the icon with the key, after the ignition check, must flash with a frequency of 1 Hz and then turn off after 10 seconds to indicate the performed reset. If the button is released before the 10 seconds, the icon is not reset.

ADJUSTMENT PROCEDURE OF THE RING NUTS OF THE SIDE HEADSTOCKS

- Remove the windscreen.
- Remove the central cover fixed to the joints on the legshield.

- Unscrew the two screws and remove the lower cover of the spoiler.

- Remove the two screws located inside the glove-box on the dashboard.

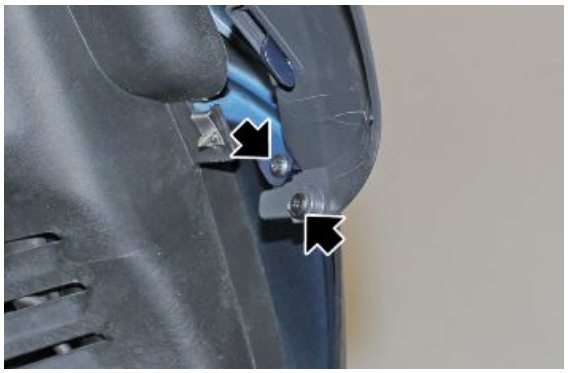
- Remove the two screws indicated on both sides, recovering the relative spacers.

- Unscrew the lower screw indicated on both sides, and recover the washers, then remove the spoiler.

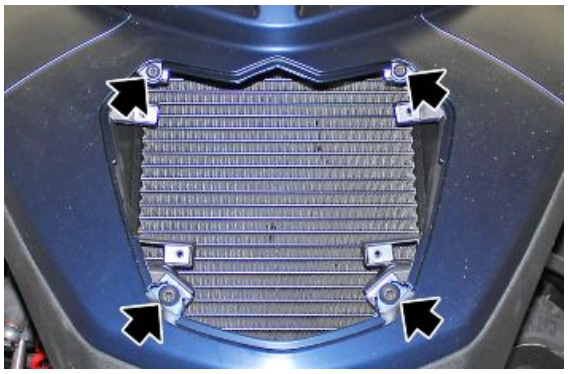
- Remove the two headlight upper fixing screws.

- Unscrew the four screws shown and remove the radiator grille complete with frame.

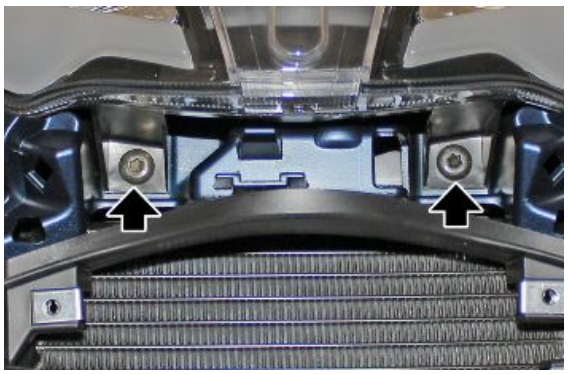
- Working on both sides of the vehicle, remove the two screws in the wheel housing.



- Unscrew the four indicated screws and remove the front radiator cover.

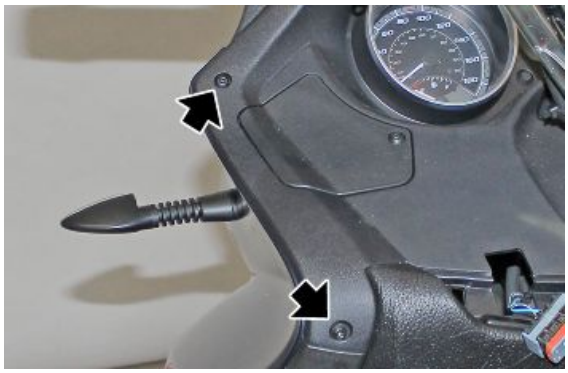


- Remove the two headlight lower fixing screws.

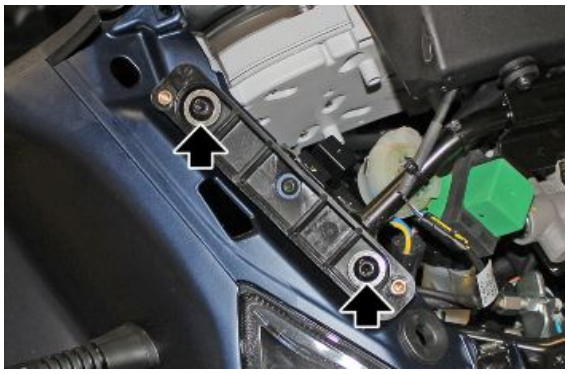


- Disconnect the connector and remove the headlight.

- Unscrew the two indicated screws on both sides.

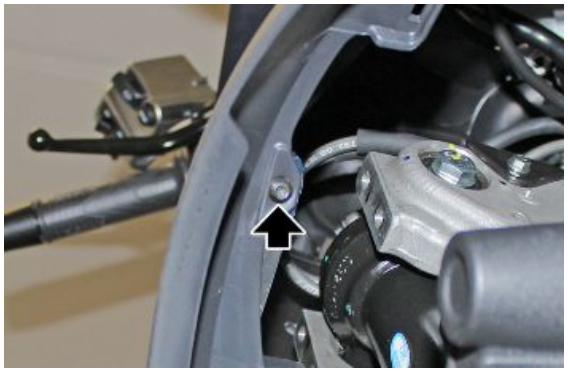


- Working from both sides of the vehicle, unscrew the two screws shown, recovering the washers; then remove the top fairing support plastic.



- Remove the two screws below.

- Remove the two indicated screws from both sides of the vehicle, located inside the wheel housing.
- Disengage the fittings on the lower part of the shield and move it away from the vehicle, complete with side legshields and turn indicators; then disconnect the connectors of these latter.



WARNING

DURING THE REFITTING, PAY PARTICULAR ATTENTION TO THE CORRECT POSITION OF THE TWO SPOILER SUPPORT PLASTICS, REFERRING TO THE INDICATIONS ON THE PLASTIC.

Once the plastics have been remove the ring nuts of the side headstock of the front suspension can be reached

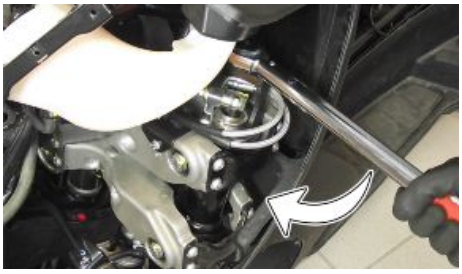
Unscrew the upper ring nut

Bring the upper ring nut to the end of the headstock thread of the side suspension

Tighten the lower ring nut to the specified torque with the appropriate key.

Locking torques (N*m)

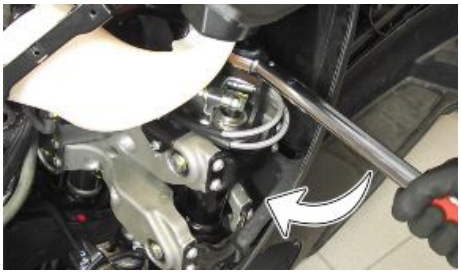
Side headstock lower ring nut **12 - 15**



Screw the upper ring nut until it stops

Tighten upper ring nut to the specified torque with the appropriate key.

Carry out the assembly of the plastic covers in reverse order to the disassembly.



Specific tooling

020892y Steering side headstock ring nut key

Locking torques (N*m)

Side headstock upper ring nut **20 - 24**

Maintenance chart

SCHEDULED MAINTENANCE TABLE

I: *CHECK AND CLEAN, ADJUST, LUBRICATE OR REPLACE IF NECESSARY.*
C: *CLEAN,* ***R:*** *REPLACE,* ***A:*** *ADJUST,* ***L:*** *LUBRICATE*

km x 1,000 (mi x 1,000)	1 (0.6)	10 (6.2)	20 (12.4)	30 (18.6)	40 (24.9)	50 (31.1)	Every 12 months	Every 24 months
Safety blocks	I	I		I		I		
Spark plugs		R	R	R	R	R		
Centre stand		L	L	L	L	L	L	L
Roll lock calliper control cable		A	A	A	A	A		
Drive belt		R	R	R	R	R		
Throttle control	A	A	A	A	A	A	I	I
Diagnosis by tool	I	I	I	I	I	I	I	I
Air filter		R	R	R	R	R		
Engine oil filter	R	R	R	R	R	R	R	R
Valve clearance		A	A	A	A	A		
Clutch assembly		I	I	I	I	I		
Electrical system and Battery	I	I	I	I	I	I		
Braking system	I	I	I	I	I	I		
Coolant	I	I	I	I	I	I	I	R
Brake Fluid	I	I	I	I	I	I	I	R
Engine oil	R	R	R	R	R	R	R	R
Hub oil	R	I	R	I	R	I	I	I
Headlight direction adjustment		I		I		I		
Brake pads	I	I	I	I	I	I	I	I
Sliding shoes / CVT rollers		R	R	R	R	R		
Tire pressure and wear	I	I	I	I	I	I	I	I
Test drive	I	I	I	I	I	I	I	I
Driven pulley - roller casings		I	I	I	I	I		
Suspensions		I	I	I	I	I	I	I
Centre and side steering	A	A	A	A	A	A	I	I
Transmission		I	I	I	I	I	I	I
Labour time (minutes)	115	200	230	200	230	200	60	60

N.B.

AT EACH SCHEDULED MAINTENANCE MUST BE VERIFIED WITH THE DIAGNOSTIC TOOL IF THERE ARE ERRORS AND THE IF THE PARAMETERS ARE CORRECT.
ENSURE THAT THE VEHICLE CALIBRATION IS UP TO DATE AFTER UPDATING THE DIAGNOSTIC TOOL.

CAUTION

ONCE THE REQUIRED MAINTENANCE PROGRAM HAS BEEN COMPLETED, THE VEHICLE'S MAINTENANCE MUST BE CONTINUED STARTING WITH THE 10,000 Km (6,214 mi).

Recommended products

Piaggio Group recommends the use of products from its Castrol official partner for the scheduled maintenance of its vehicles.

Only use lubricants and fluids which meet or exceed the performance characteristics specified.

This also applies when topping up only.

TABLE OF RECOMMENDED PRODUCTS

Product	Description	Specifications
Engine oil 5W -40	Synthetic-based lubricant for four-stroke engines.	SAE 5W-40; JASO MA, MA2; API SL; ACEA A3
Transmission oil 80W-90	Lubricant for gearboxes and transmissions.	SAE 80W-90 API GL-4
Anti-freeze liquid, ready to use, colour red	Ethylene glycol antifreeze liquid with organic inhibition additives. Red, ready to use.	ASTM D 3306 - ASTM D 4656 - ASTM D 4985 - CUNA NC 956-16
DOT 4 brake fluid	Synthetic brake fluid.	SAE J 1703; FMVSS 116; ISO 4925; CUNA NC 956 DOT4
Lubricant grease	Lithium and medium fibre yellow brown coloured grease suitable for various uses.	ISO L-X-BCHA 3 - DIN 51 825 K3K -20
Water repellent spray grease	Water repellent pouring calcium spray grease.	White, soap base spray grease with NLGI 2 Calcium complex; ISO-L-XBCIB2

MEASUREMENT UNITS CONVERSION - FROM THE ANGLO-SAXON SYSTEM TO THE INTERNATIONAL SYSTEM (I.S.).

Specification	Desc./Quantity
1 Inch (in)	25.4 Millimetres (mm)
1 Foot (ft)	0.305 Metres (m)
1 Mile (mi)	1.609 Kilometres (km)
1 US gallon (gal US)	3.785 Litres (l)
1 Pound (lb)	0.454 Kilograms (Kg)
1 Cubic inch (in^3)	16.4 Cubic centimetres (cm^3)
1 Pound per foot (lb ft)	1.356 Newton metres (N m)
1 Mile per hour (mi/h)	1.602 Kilometres per hour (km/h)
1 Pound per square foot (PSI)	0.069 (bar)
1 Fahrenheit (°F)	32+(9/5) Celsius (°C)

Anti-evaporation system

The vehicle is equipped with the "Canister", main component of the system for the control of evaporative emissions, compliant with the current standards.

A. Fuel pump

B. Fuel tank

C. Two-way fuel vapour ventilation valve

D.Canister

E.Air purge pipe into atmosphere

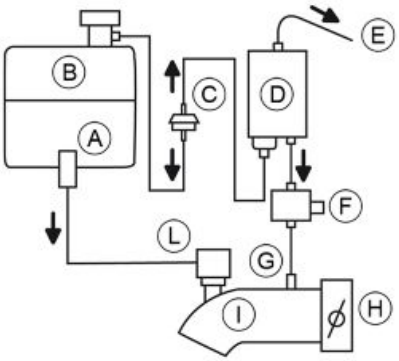
F.One-way electronic fuel vapour purge control valve (controlled by ECU)

G. Vacuum fitting

H. Throttle body

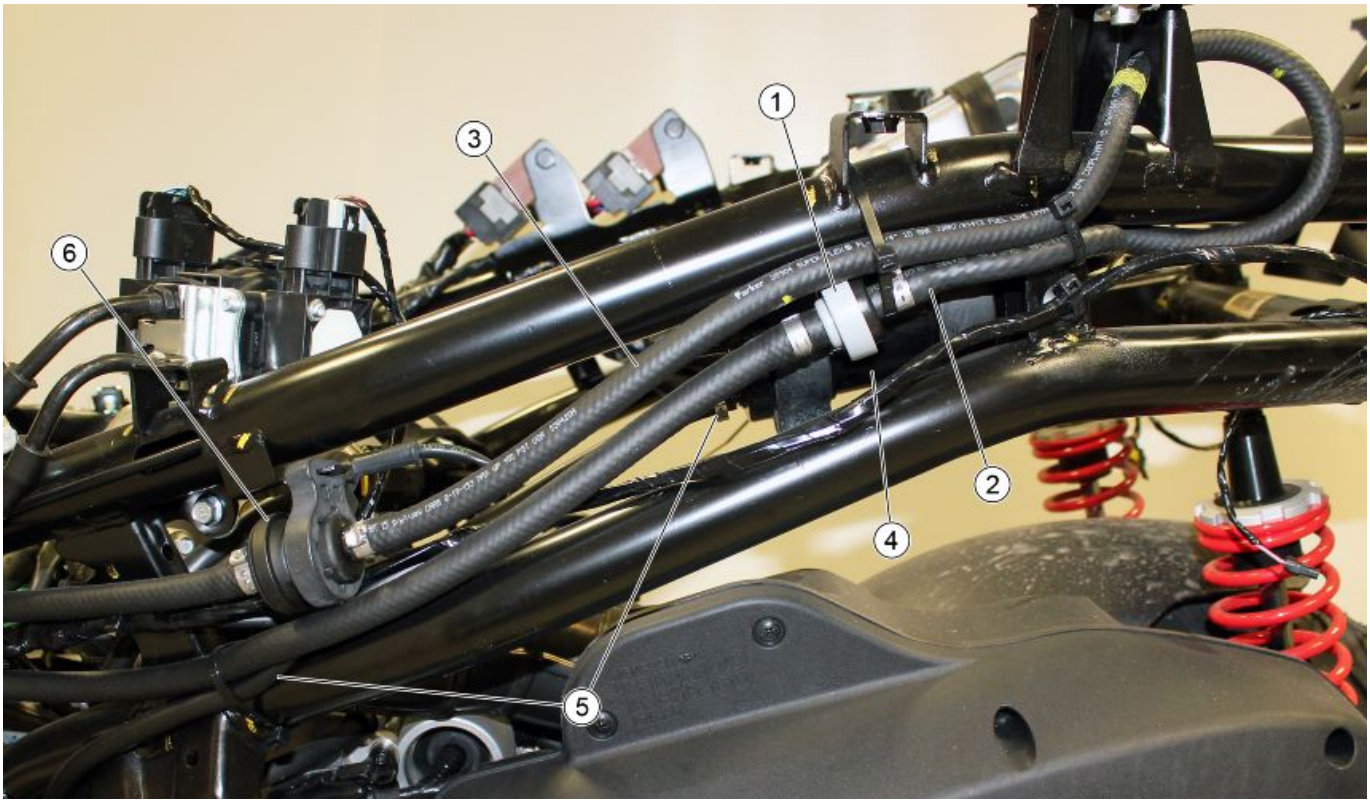
I. Air induction fitting

L. Injector



Removing system components

Remove the helmet compartment and the side fairings to gain access to the components of the evaporative emissions control system.



1. Two-way breather valve

2. Pipe for connecting the fuel tank to the canister

3. Pipe for connecting the canister to the inlet fitting

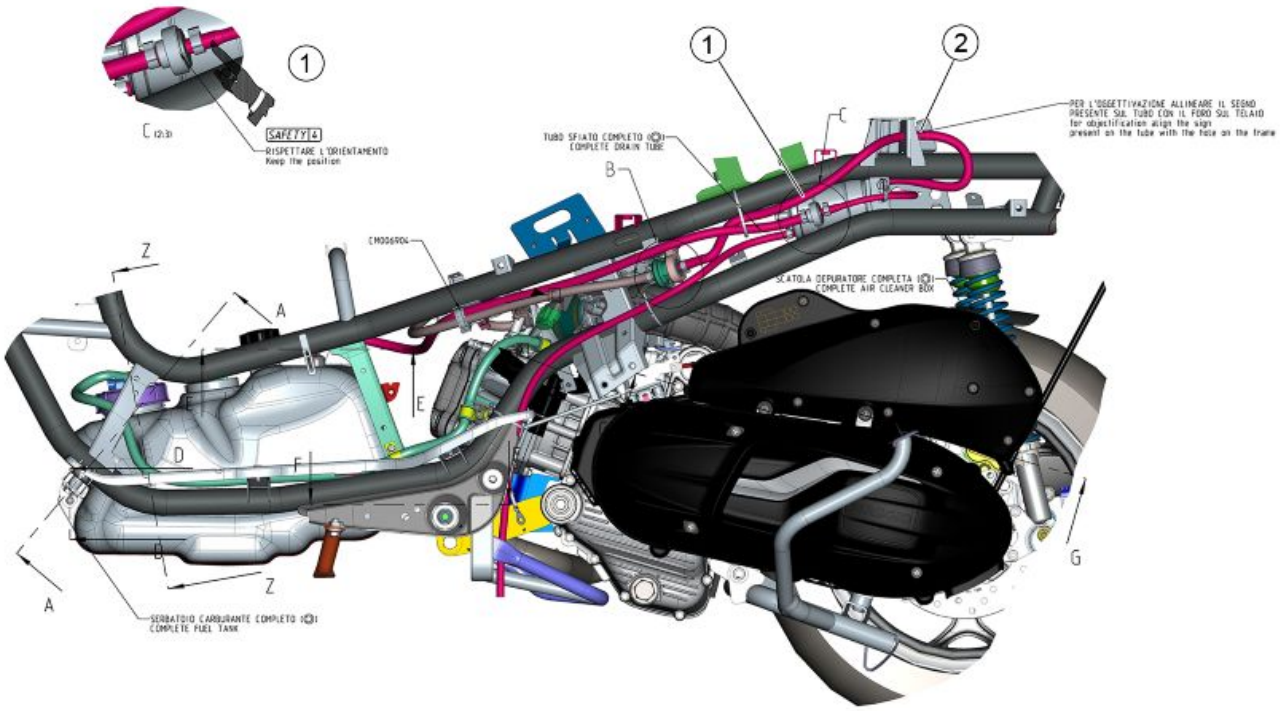
4. Canister

5. Bleeder pipe

6. One-way electronic valve

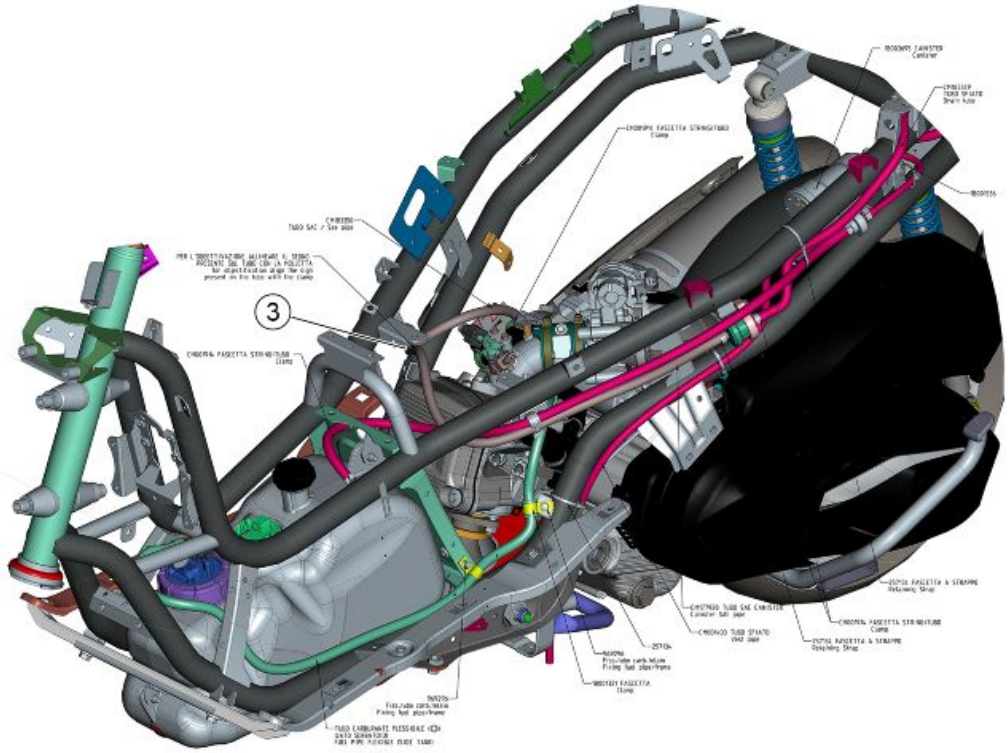
Refitting system components

Upon reassembling the components, use caution when connecting the pipes to the canister.

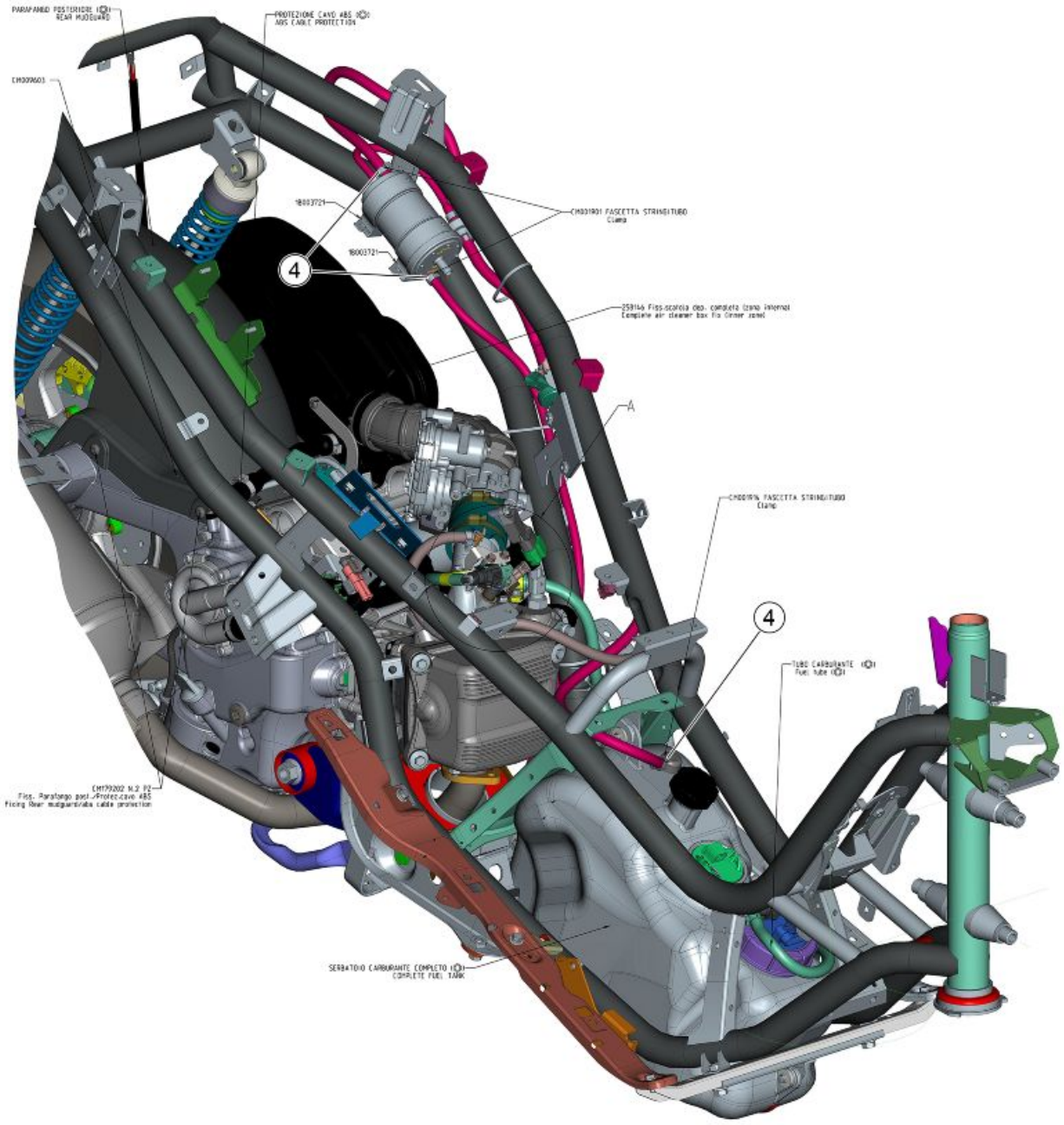


1. **OBSERVE THE DIRECTION**

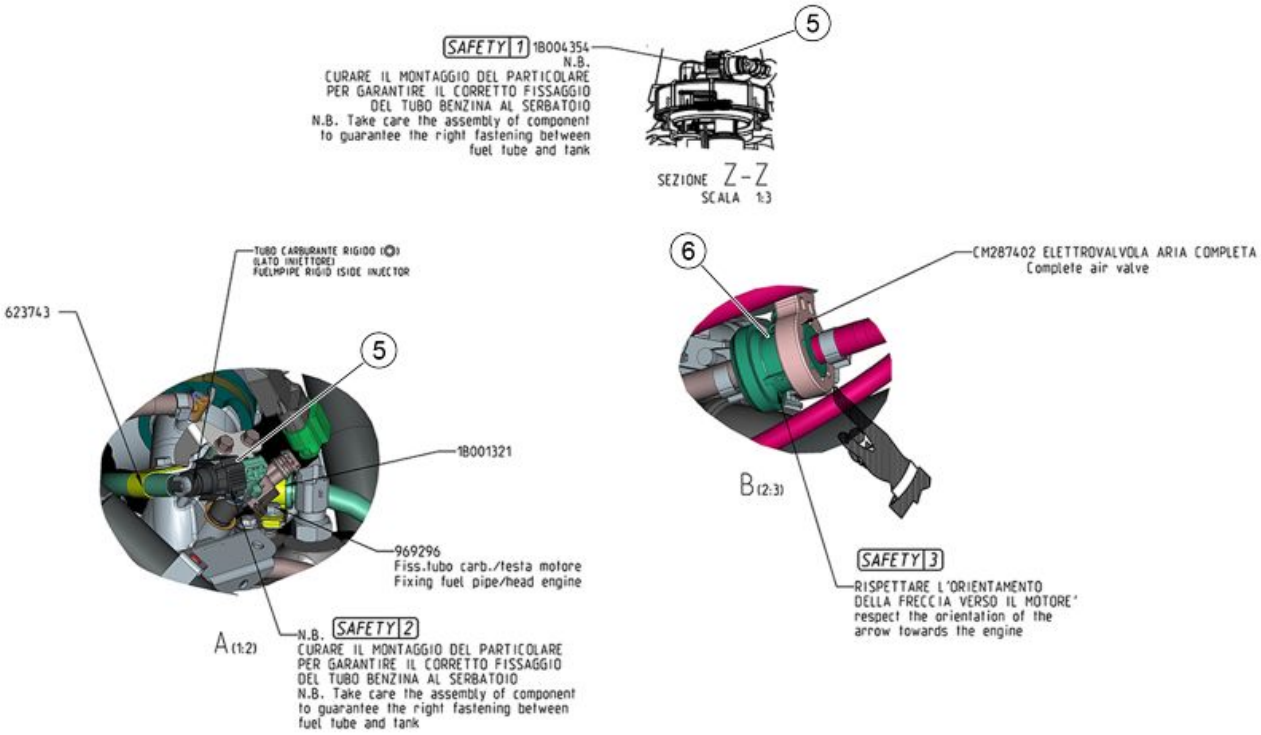
2. Align the mark on the pipe with the hole on the frame



3. Align the mark on the pipe with the clip


PARAFANGO POSTERIORE
REAR MUDGUARD
PROTEZIONE CAVO ABS
ABS CABLE PROTECTION
CH009603
18003721
18003721
CH001901 FASCETTA STRINGITUBO
Clamp
4
259146 Fiss.scatola agg. completa (zona interna)
Complete air cleaner box fix (inner zone)
A
CH001916 FASCETTA STRINGITUBO
Clamp
4
TUBO CARBURANTE
Fuel tube
CH179202 N.2 PZ
Fiss. Parafango post./Protez.cavo ABS
Fixing Rear mudguard/abs cable protection
SERBATOIO CARBURANTE COMPLETO
COMPLETE FUEL TANK

4. Pipe clamp



5. TAKE CARE OF THE FITTING OF THE PART TO ENSURE THE CORRECT FIXING OF THE FUEL PIPE TO THE TANK

6. OBSERVE THE DIRECTION OF THE ARROW TOWARD THE ENGINE

CAUTION

TAKE CARE TO ENSURE THE PROPER DIRECTION OF THE COMPONENTS' INSTALLATION: IF INSTALLED IN REVERSE, THEY COULD COMPROMISE THE FUNCTIONALITY OF THE ENTIRE EVAPORATING SYSTEM.

After having installed the components, secure the pipes with new ties.

Canister inspection

The canister is essential to treat the hydrocarbons present in the volume of gas that escapes from the tank when there is an increase in internal pressure (tank heating induced by the cooling radiator, by the motor or by the external environment).

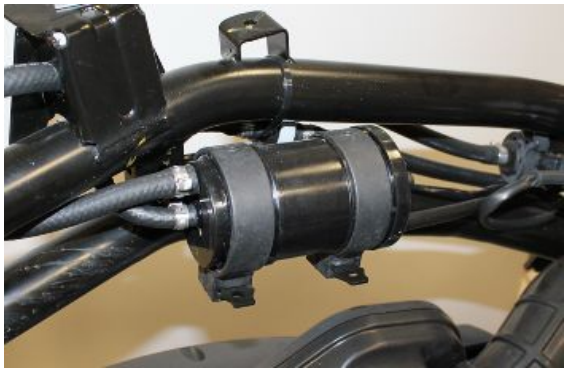
Although the amount of hydrocarbons coming from the tank is small enough to avoid the saturation of the canister, it is necessary to regenerate the activated carbon by means of a reversed flow of ambient air sucked by the engine.

These vacuums of pollution and carbon regeneration take place at each cycle of use of the vehicle.

To control the canister, it is necessary to proceed with its removal while keeping the 2 pipes connected.

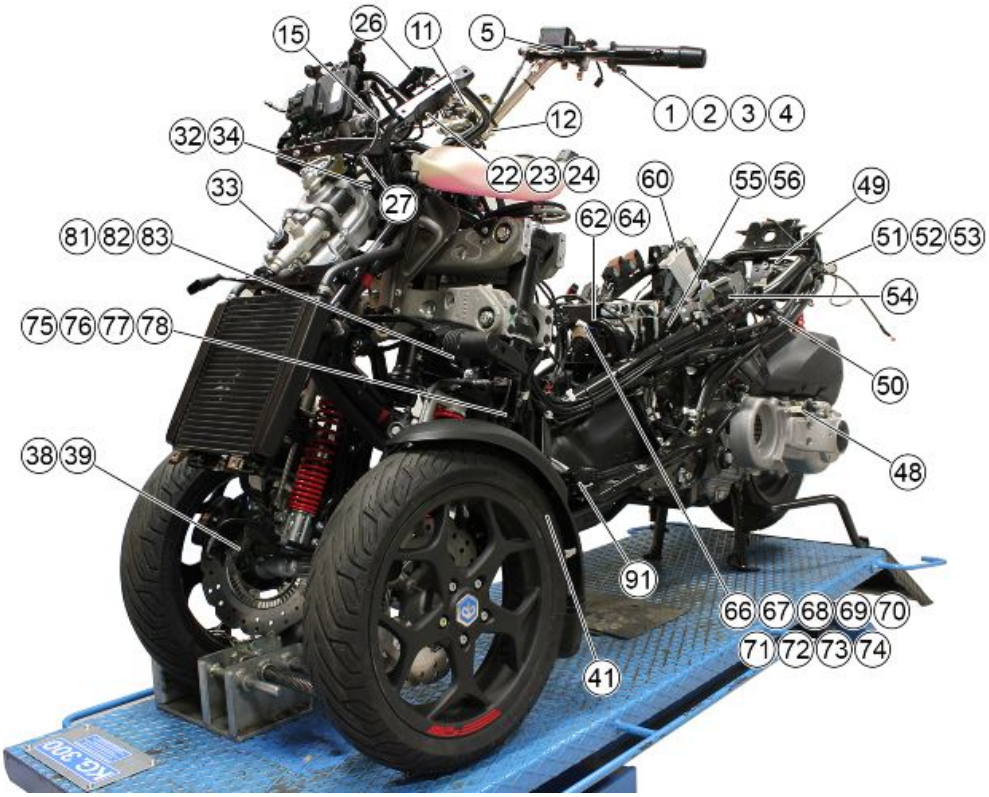
- Shake the Canister and make sure there is no noise.
- Using a compressed air gun, blow alternately in 3 ducts and make sure that pressure does not build inside the canister.
- Check that the air flow is kept free and that no carbon residues escape out of any pipe.

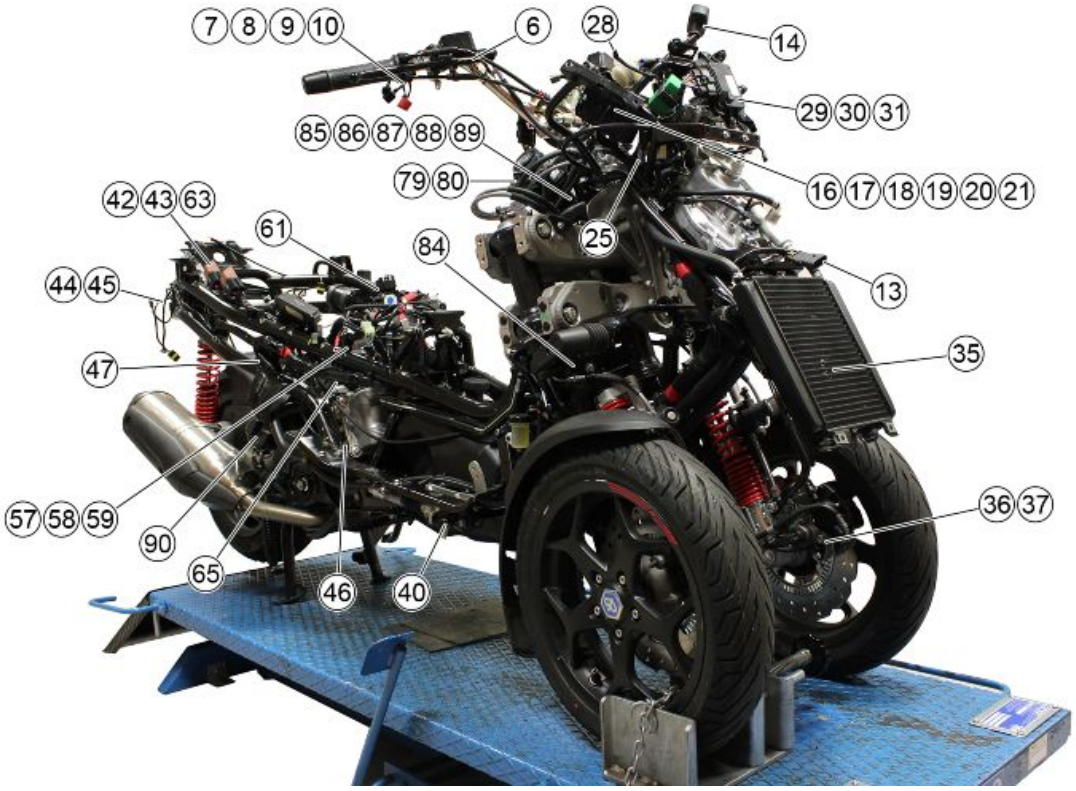
If you detect noise, clogging or loss of carbon, replace the canister.



INDEX OF TOPICS

Components arrangement





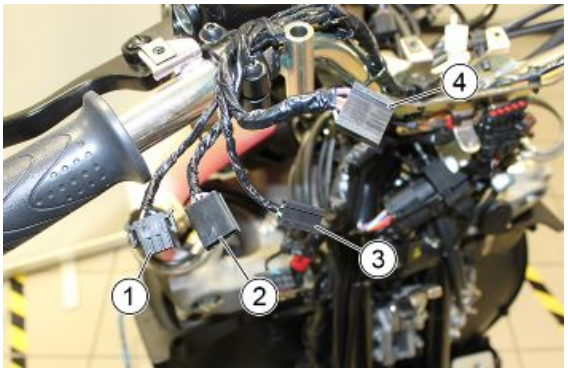
Remove the upper handlebar cover to access the following components:

01. Horn button connector

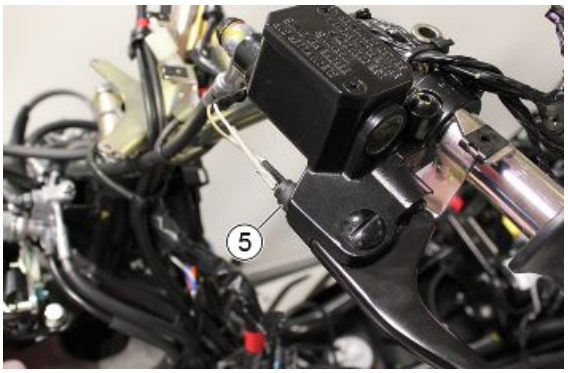
02. Turn indicators switch connector

03. CONNECTIVITY button connector

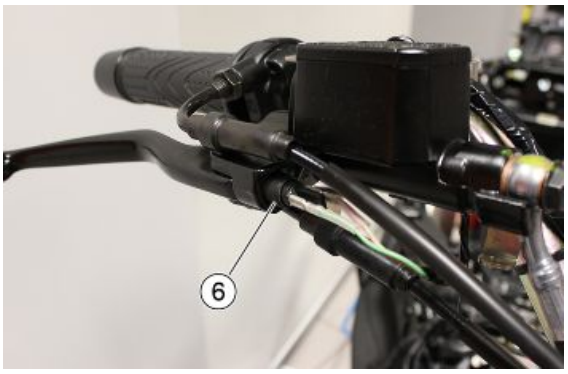
04. Light switch connector



05. Left stop button



06. Right stop button

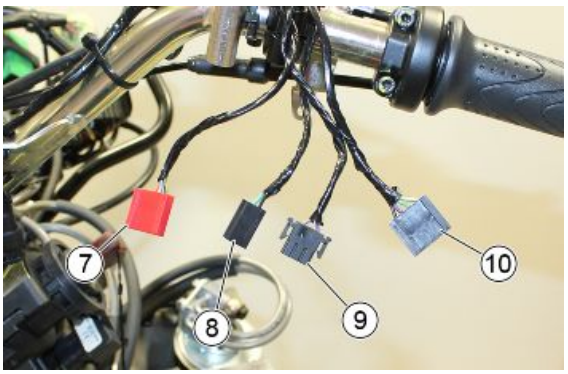


07. RUN/OFF switch connector

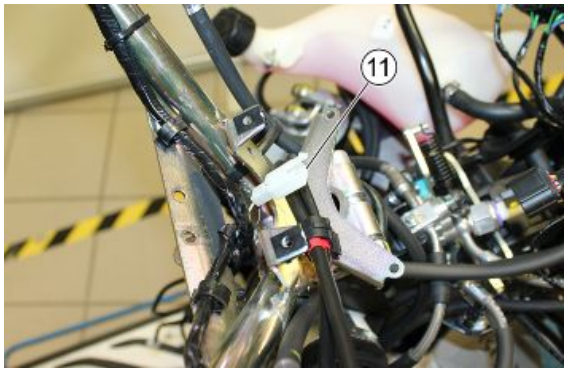
08. MODE button connector

09. Starter button connector

10. Front suspension lock-unlock switch connector



11. Ambient temperature sensor



Remove the lower handlebar cover to access the following components:

12. Heated accessories pre-installation

Remove the spoiler to access the following components:

13. Front light assembly connector

14. Instrument panel connector

15. Indicator lights unit connector

16. Horn relay

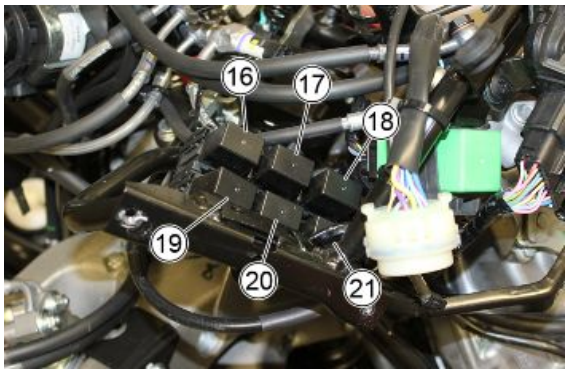
17. Engine stop remote control switch

18. Electric fan relay

19. Stop lights relay

20. Headlight relay

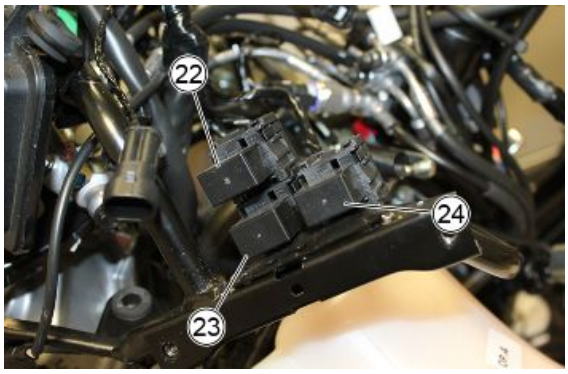
21. Injection load relay



22. Solenoid relay

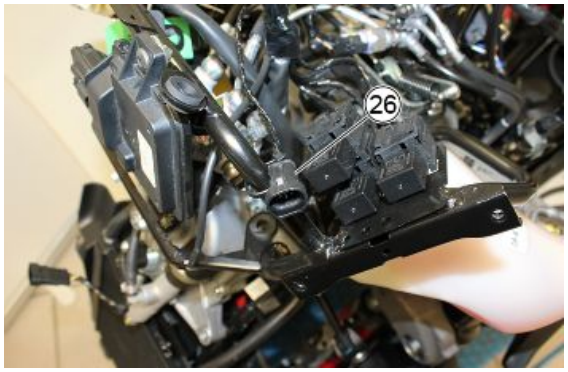
23. Fuel pump relay

24. Actuator relay



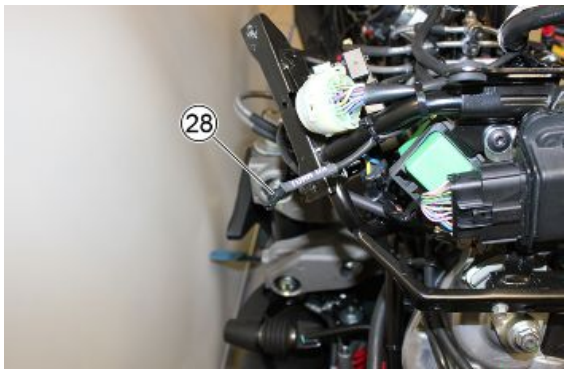
25. Gear motor

26. USB port connector



27. Front left turn indicator connector

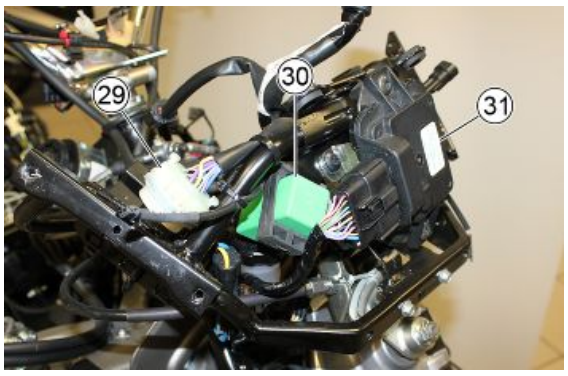
28. Front right turn indicator connector



29. Accessories pre-installation

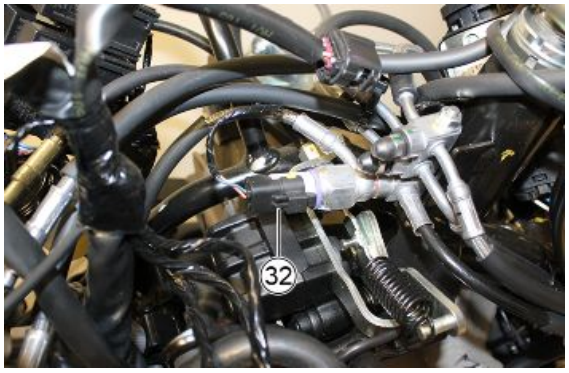
30. Turn indicators control device

31. PMP3 control unit



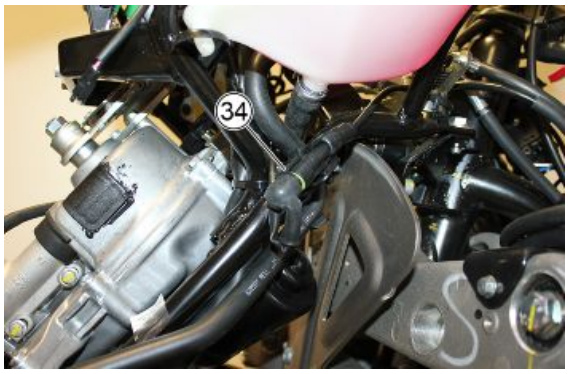
Remove the front shield to access the following components:

32. Pressure sensor



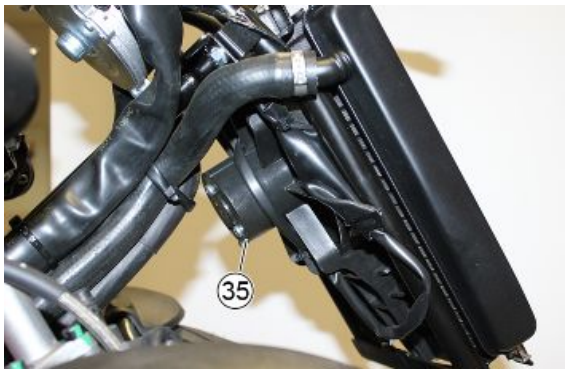
33. Rotation sensor

34. Brake calliper sensor



Remove the radiator cover to access the following components:

35. Electric fan



On the front wheels are the following components::

36. LH speed sensor

37. LH front ABS sensor

38. RH front ABS sensor

39. RH speed sensor

Remove the right footrest to access the following components:

40. Brake pedal stop button

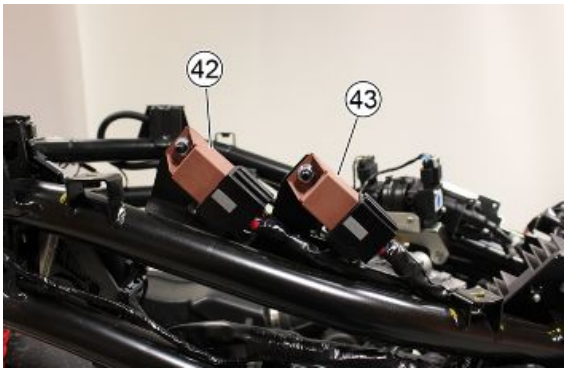
Remove the left footrest to access the following components:

41. Horn

Remove the right fairing to access the following components:

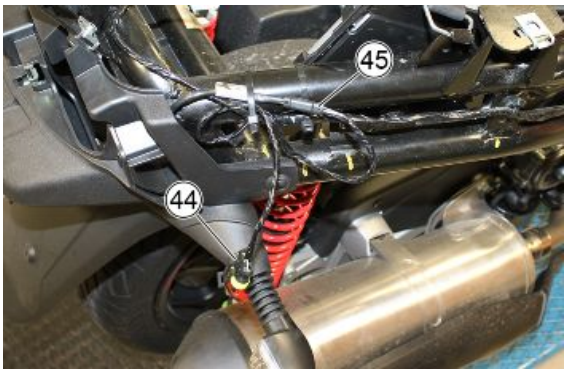
42. Reverse gear enable relay

43. Reverse gear motor relay

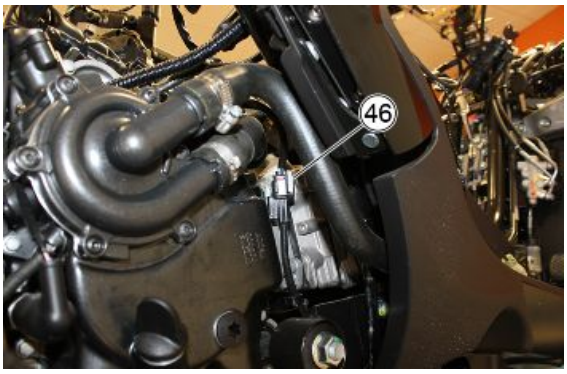


44. RH rear headlight assembly connector

45. Rear RH turn indicator connector



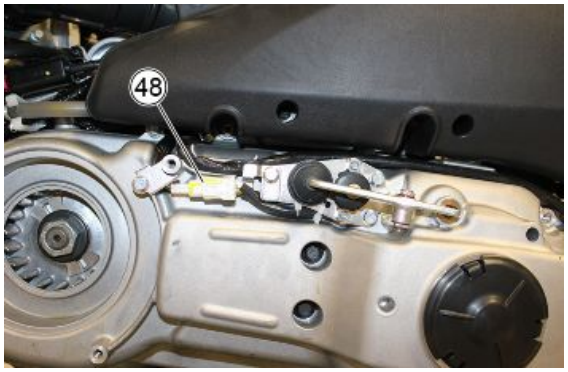
46. Lambda probe



47. Pick-up

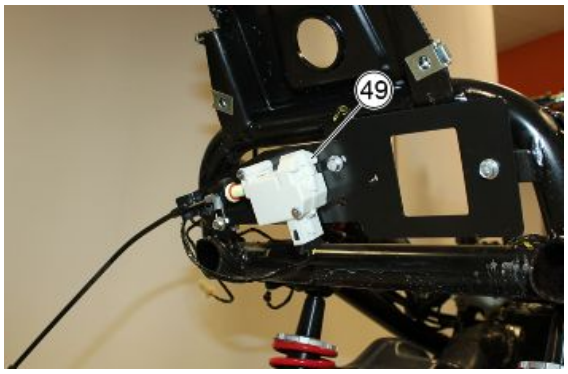
Remove the transmission cover to access the following components:

48. Reverse gear actuator



Remove the license plate light support to access the following components:

49. Saddle opening actuator



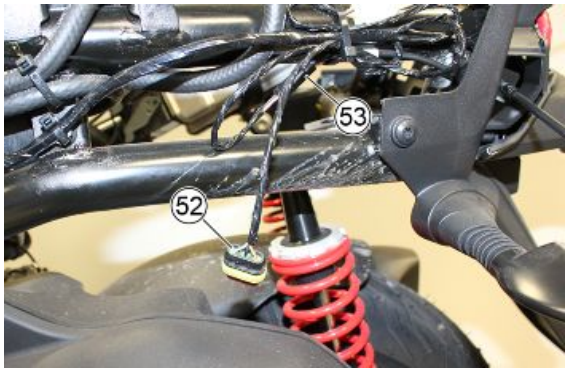
Remove the left fairing to access the following components:

50. Canister solenoid valve

51. Licence plate light connector

52. LH rear headlight assembly connector

53. Rear LH turn indicator connector



54. H.V. coil.

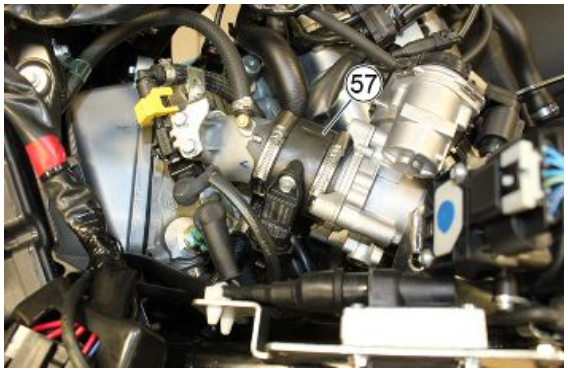
Remove the inspection cover, located in the helmet compartment, to access the following components:

55. Throttle body

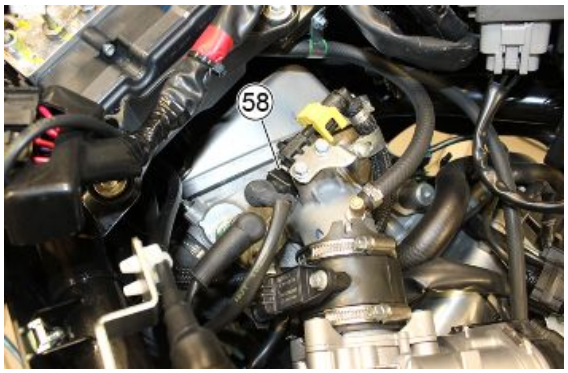
56. Rear ABS sensor

Remove the helmet compartment to access the following components:

57. T-Map sensor



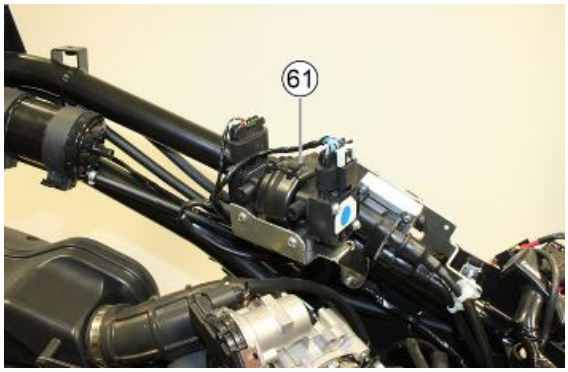
58. Injector



59. Engine temperature sensor

60. Injection ECU

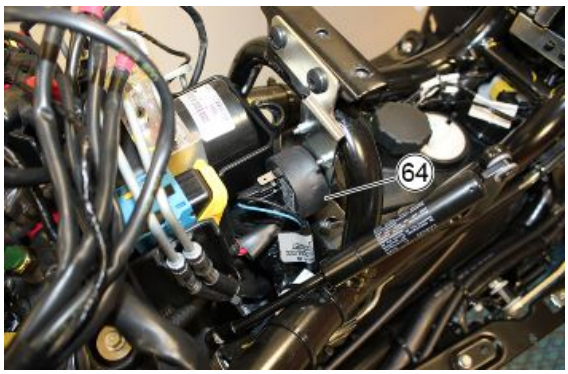
61. Throttle control position sensor



62. ABS control unit

63. Voltage regulator

64. Reverse gear buzzer

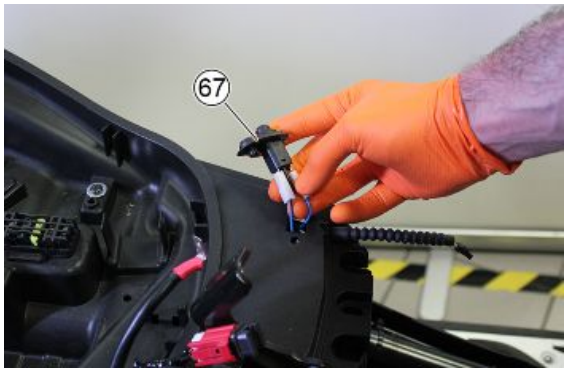


65. Starter Motor

Open the saddle to access the following components:

66. Rider detection sensor

67. Helmet compartment light switch



68. Battery

69. Fuse No. 14

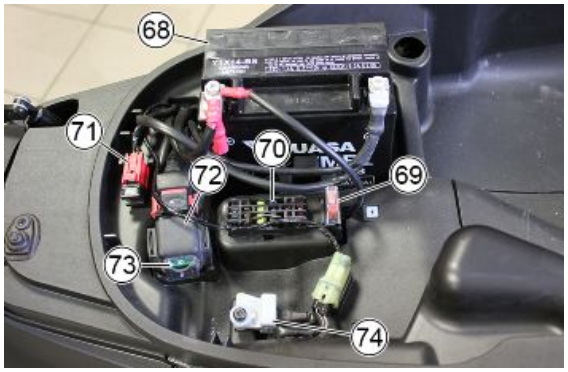
70. Secondary fuses "A"

71. OBD socket

72. Starter relay

73. Fuse No. 13

74. Fall sensor



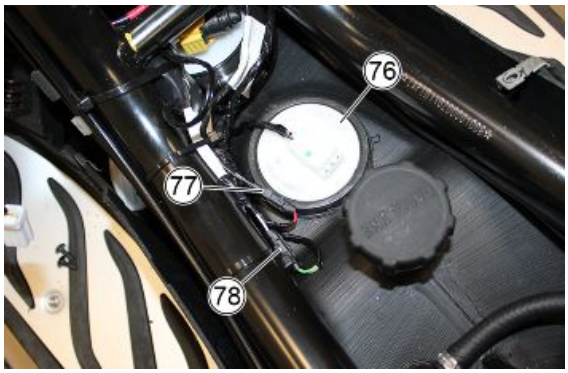
Remove the central cover to access the following components:

75. Fuel pump

76. Fuel level transmitter

77. RH speed sensor connector

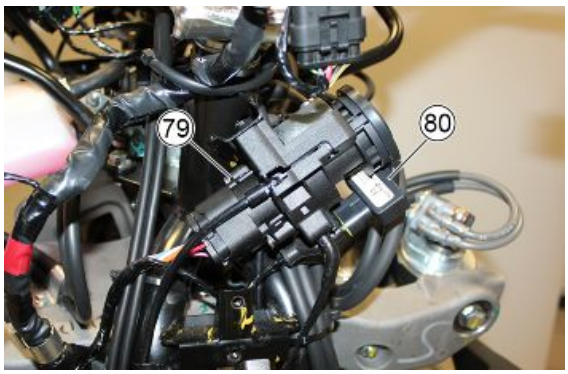
78. LH speed sensor connector



Remove the leg shield back plate to access the following components:

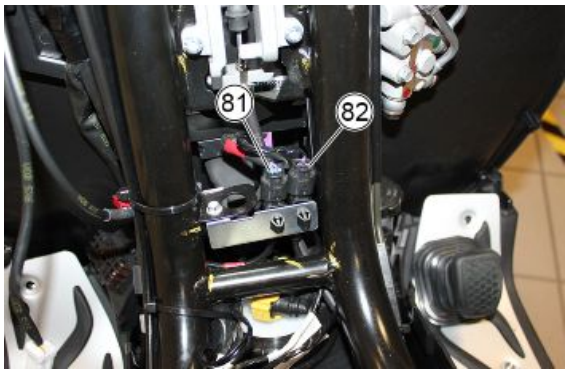
79. Ignition switch

80. Immobilizer antenna



81. LH front ABS sensor connector

82. Rh front ABS sensor **connector**



83. Parking brake

84. Parking control ECU

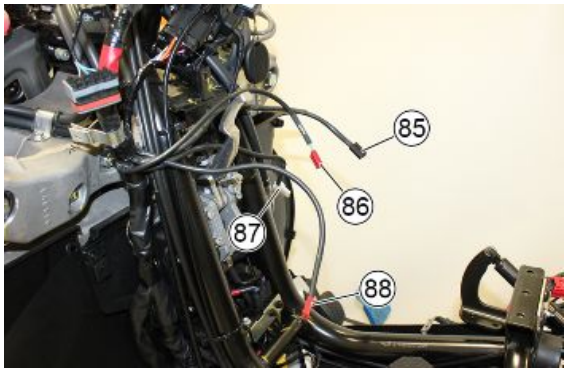
Remove the buttons unit, located in the upper part of the leg shield back plate to access the following components:

85. Saddle opening switch connector

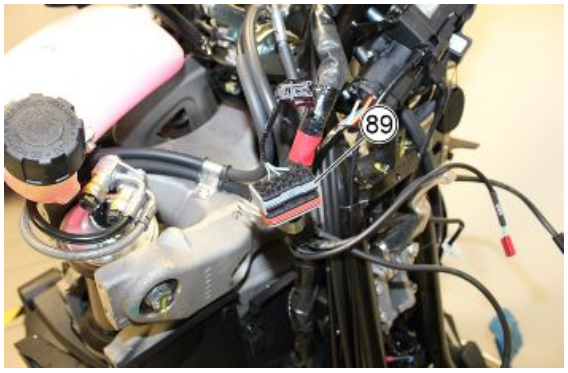
86. ASR Button connector

87. Light switch connector

88. Emergency hazard warning light button connector (Hazard)

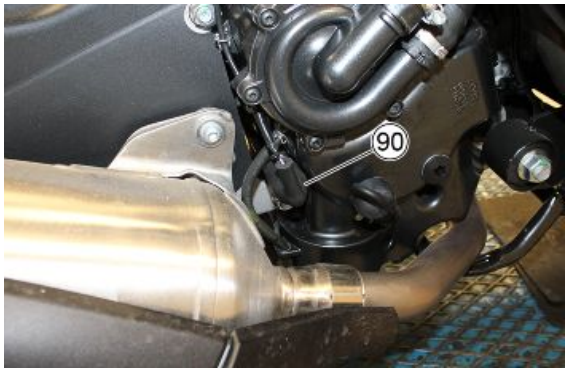


89. Drive / Reverse mode selector connector



On the right fairing is located the engine oil pressure sensor.

90. Engine oil pressure sensor

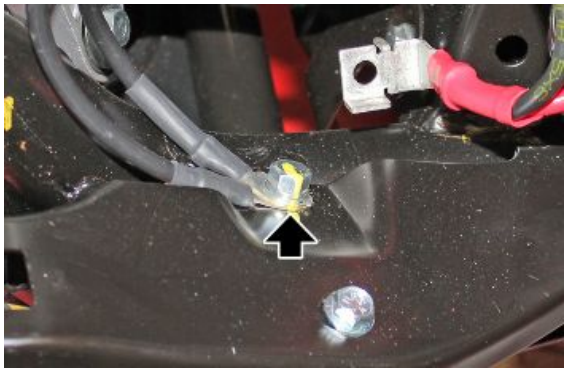


On the left fairing, remove the relative cover to access the secondary fuse holder "**B**":

91. Secondary fuses "B"

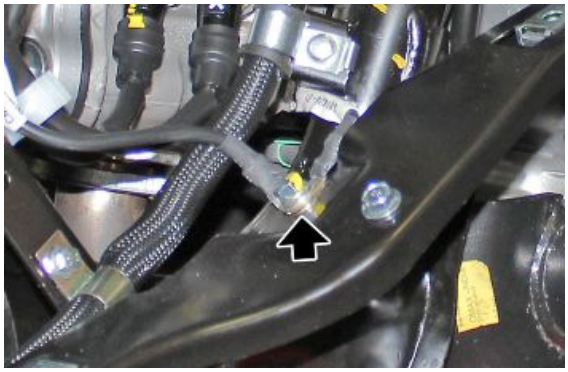
Ground points

On the vehicle there is a chassis ground point **"A"**, remove the footrest to access it.



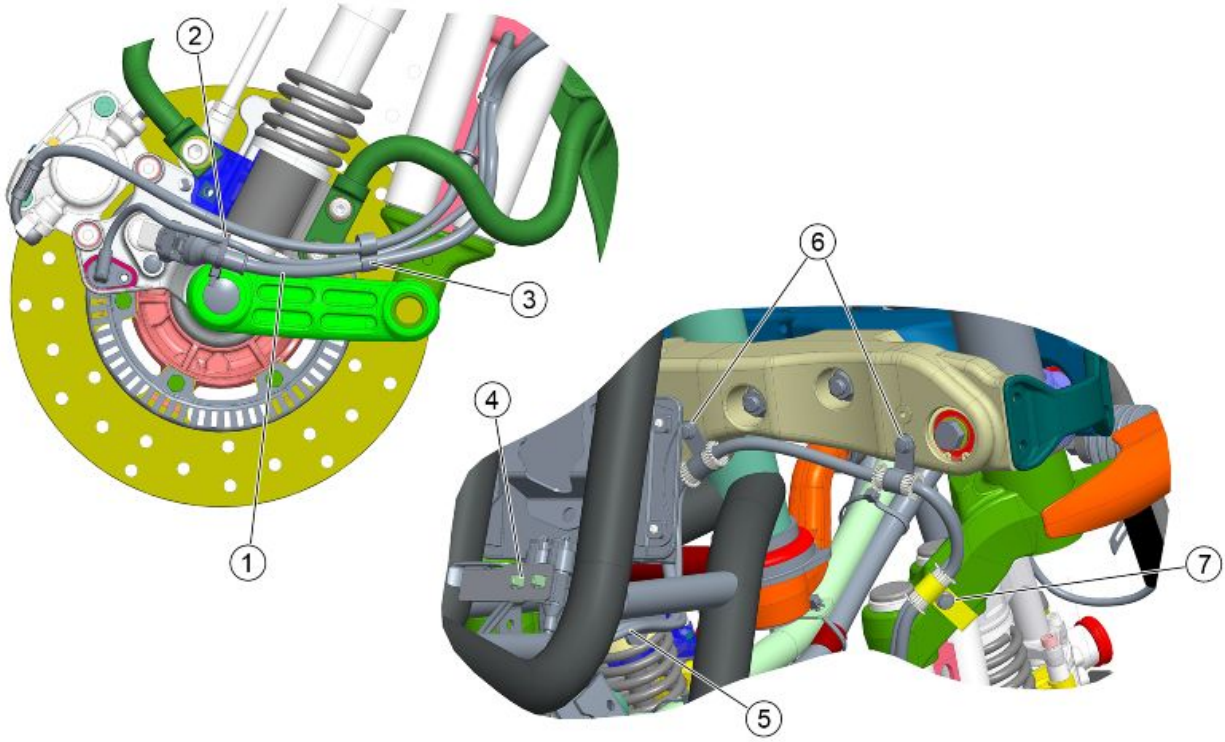
There is another ground point **"B"** on the starter motor, remove the helmet compartment to reach it.

On the left side of the vehicle is an engine-chassis ground cable «**C**» fixed, remove the footrest and the side fairing to reach it.



Electrical system installation

Front side



1. Speed sensor - front ABS sensor wire unit

2. Lock with a clamp

3. Lock with the special clamp

4. Lock the front ABS sensors connectors with the corresponding clips

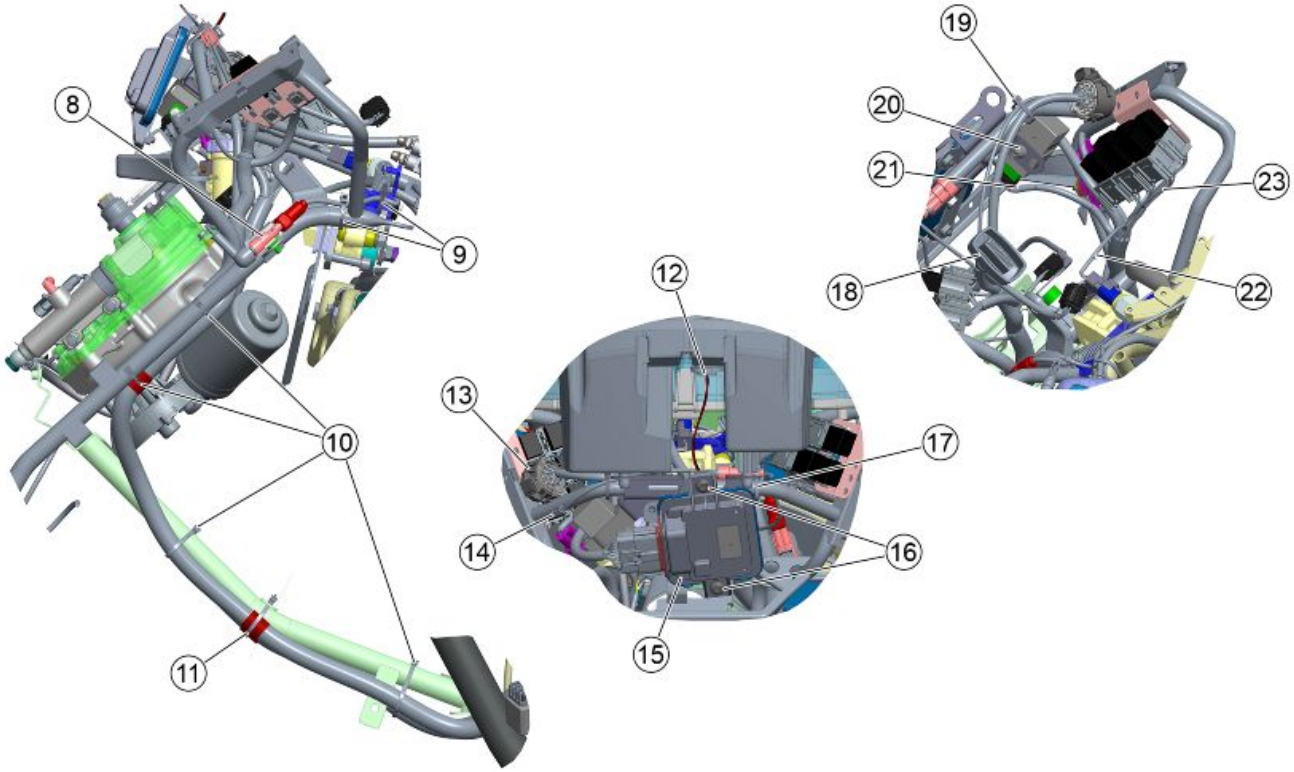
5. Insert the clip on the cable in the frame hole

6. Tighten the metal clamps to the specified torque

7. Tighten the metal clamps to the specified torque

Locking torques (N*m)

Front wheels sensors cable unit metal clamps 6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)



8. Brake calliper sensor connector

9. Lock with a clamp

10. Lock with a clamp

11. Tighten a clamp on the perforated bracket

12. USB port

13. Accessories pre-installation

14. Front right turn indicator connector

15. PMP3 control unit

16. Tighten the fastening instruments on the PMP3 control unit to the specified torque

17. Fastening of connection for USB socket

18. Instrument panel connector

19. Tighten the cables of the turn indicator and of the accessory pre-installation with a clamp

20. Turn indicators control device with elastic support

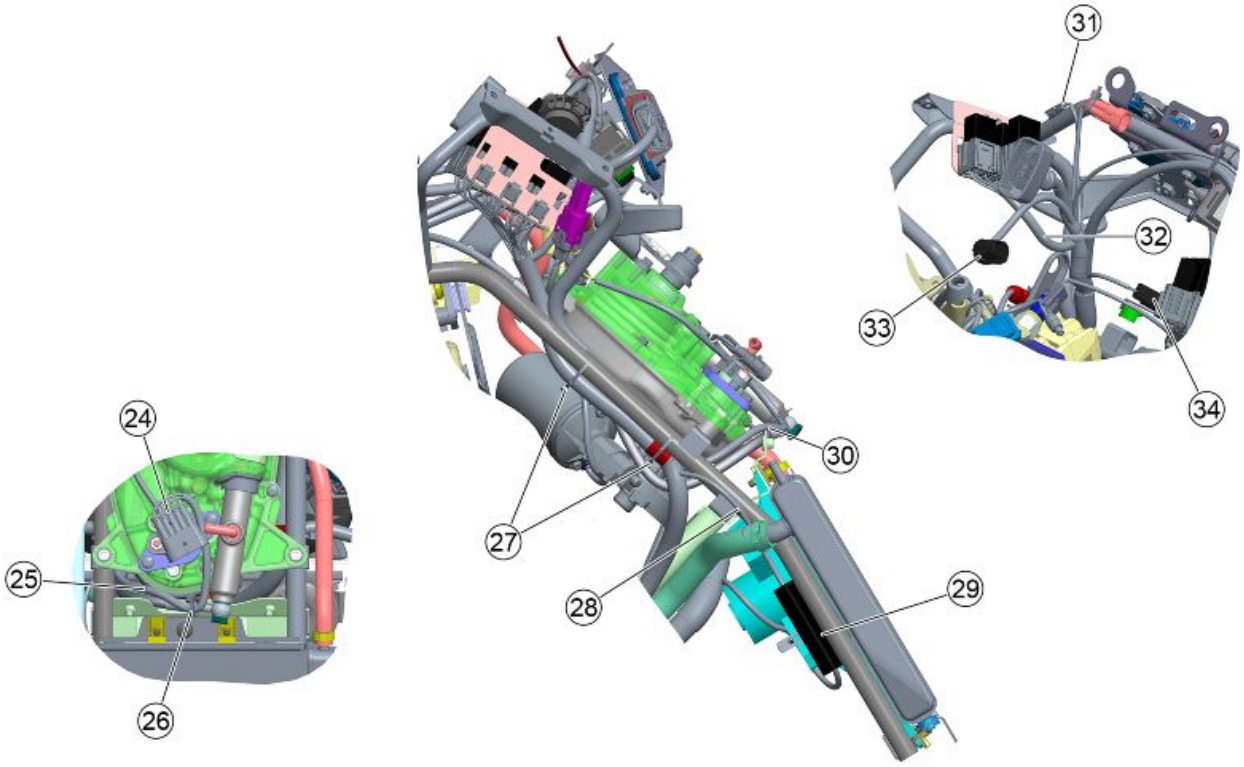
21. To the turn indicators control device

22. To the pressure sensor

23. To the relays RH side

Locking torques (N*m)

PMP3 control unit 6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)



24. Headlight connector

25. From the main wire unit

26. Fasten the branches of the headlamp

27. Lock with a clamp

28. To electric fan

29. Fasten the protection sheath of the electric fan connector by closing the metal clamp

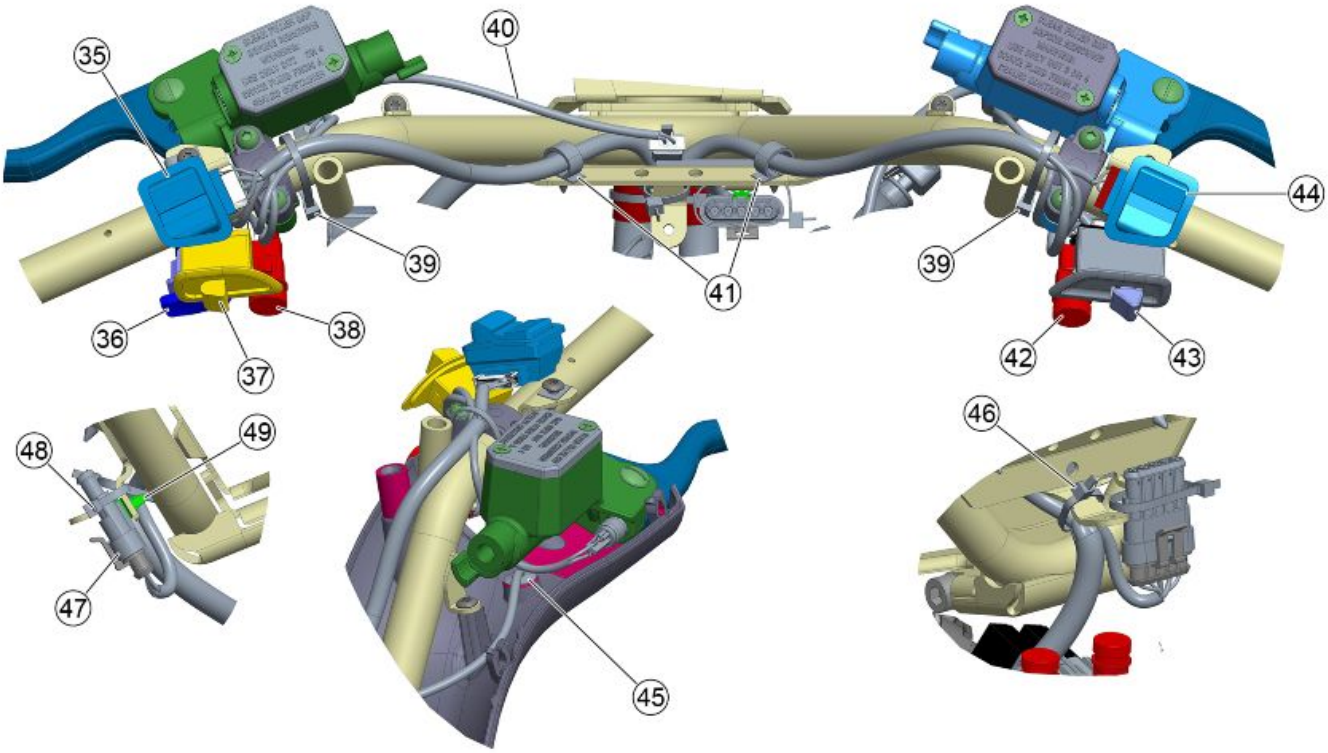
30. At headlight

31. Front left turn indicator connector

32. To the relays LH side

33. Indicator lights unit connector

34. Rotation sensor connector



35. Light switch

36. Horn button

37. Turn signal selector

38. CONNECTIVITY button

39. Lock with a clamp

40. To ambient temperature sensor

41. Clamps

42. MODE button

43. Front suspension block/unblock switch

44. RUN/OFF switch

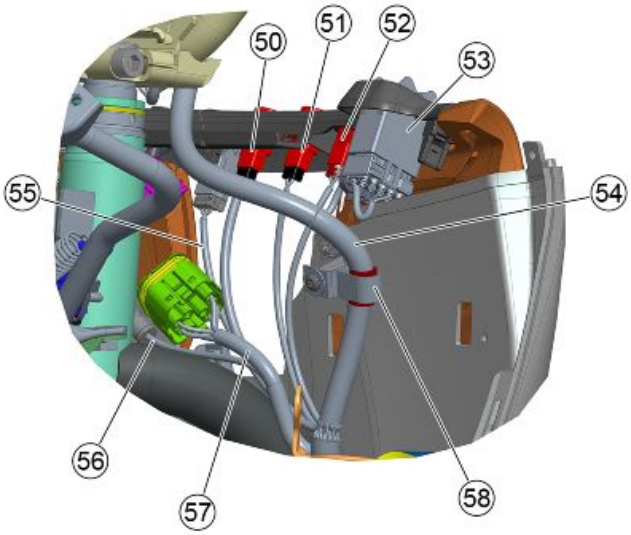
45. Insert the ambient temperature sensor in the hole on the lower handlebar cover

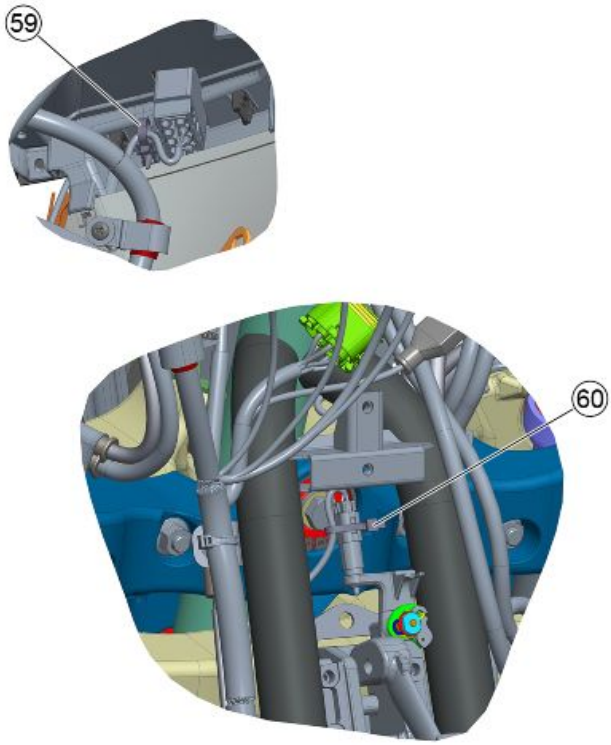
46. Tighten the wiring harness to the handlebar with a clamp

47. Heated accessories pre-installation

48. Lock with a clamp

49. Connector clip





50. Saddle opening button (black connector)

51. ASR button (branch with "ASR" label)

52. Hazard button (red connector)

53. Drive / Reverse mode selector

54. To the handlebar

55. To light switch

56. To the immobilizer aerial

57. To key switch

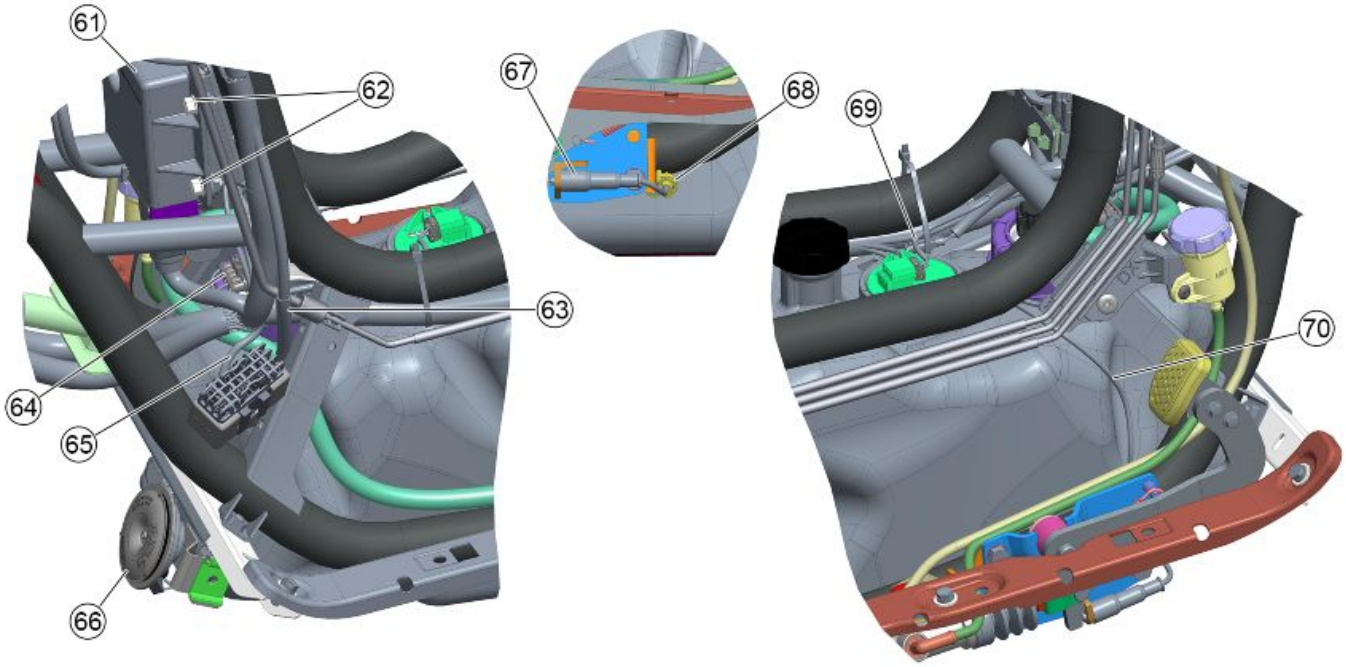
58. Fasten the metal clamp corresponding to the red taping and tighten to the specified torque

59. Insert the clamp in the ribbing of the dashboard

60. Lock with a clamp

Locking torques (N*m)

Handlebar cables unit metal clamp 1 ÷ 1,7 Nm (0.7 ÷ 1.3 lbf*ft)



61. Parking control ECU

62. Tighten the fastening instruments of the parking electronic control uni to the specified torque

63. To the front fuse box

64. Fuel pump connector

65. To horn

66. Horn

67. Fit the cap after performing the connection

68. Clamp

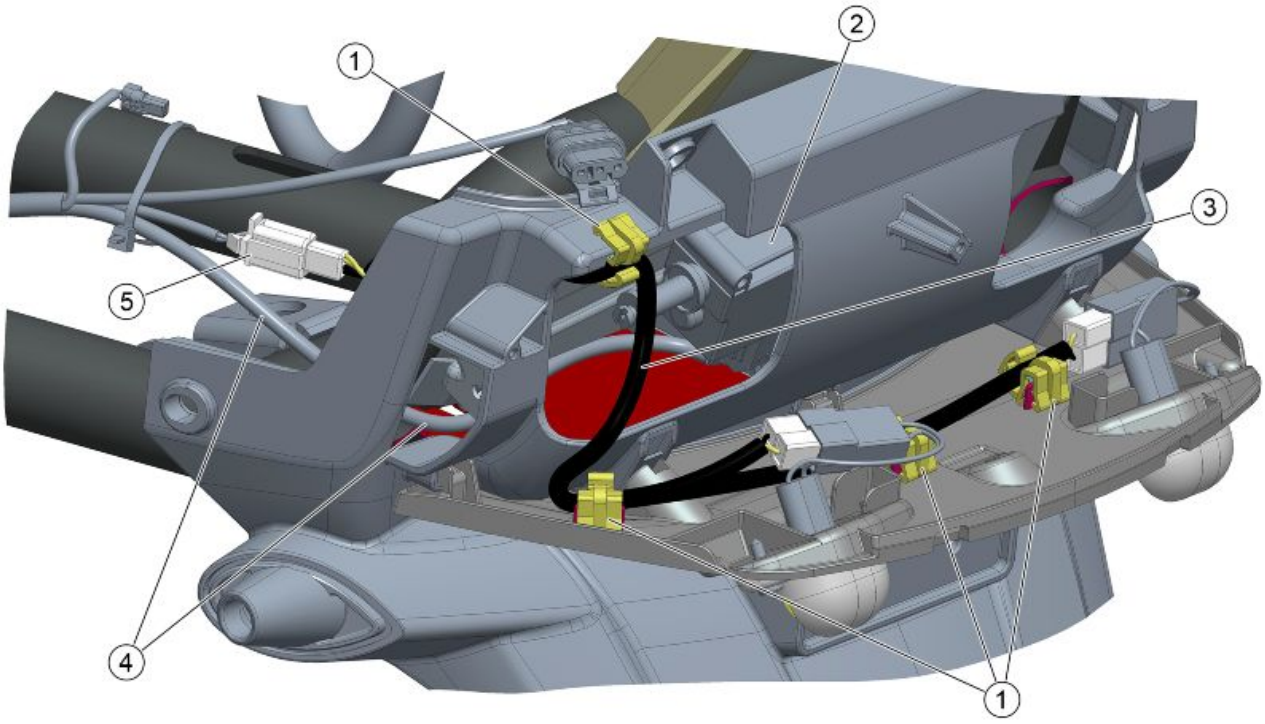
69. Tighten the speed sensor connectors and cables, the fuel level transmitter cable and the brake pedal stop button cable with a clamp

70. To the brake pedal stop button

Locking torques (N*m)

Parking control ECU 6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)

Back side



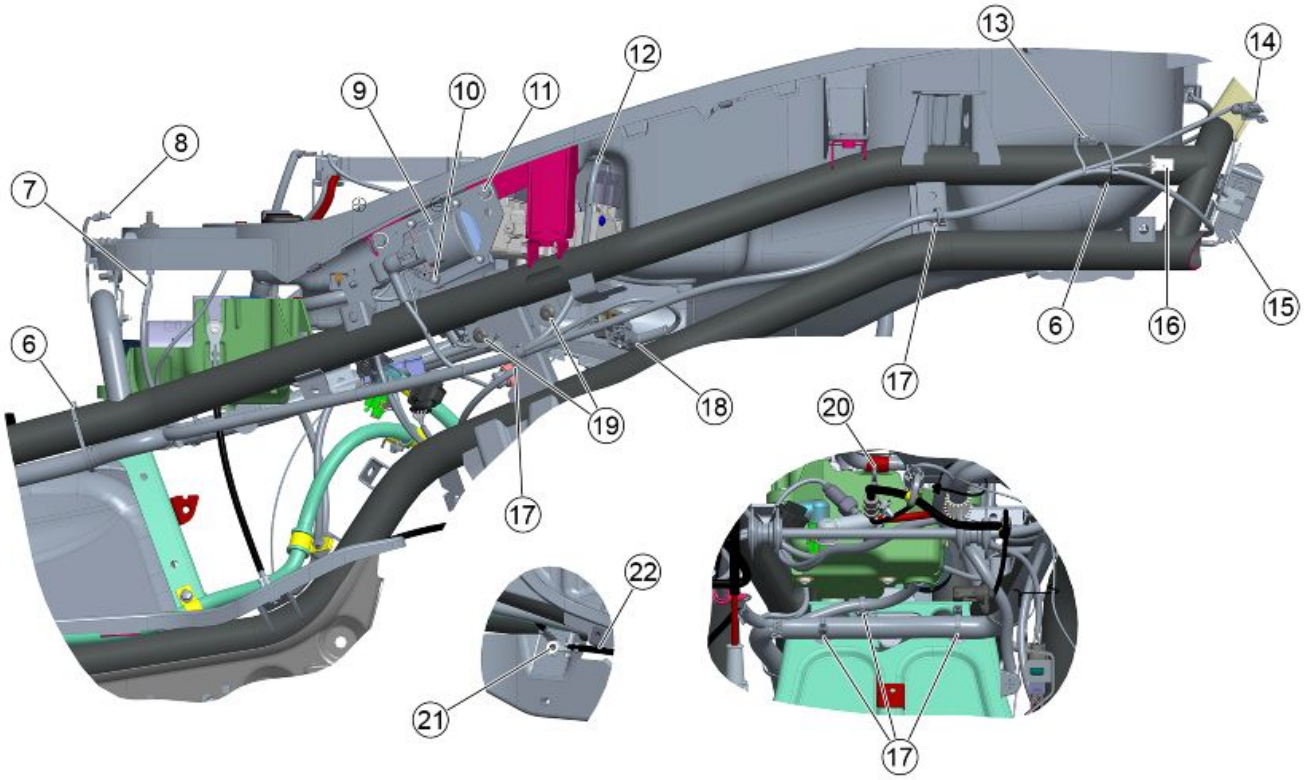
1. Clip

2. Saddle opening actuator

3. Licence plate light cable unit

4. To the saddle opening actuator

5. Main cable unit connector - licence plate light cable unit



6. Lock with a clamp

7. To helmet compartment light switch

8. Rider present sensor connector

9. H.V. coil.

10. H.V. coil ground

11. Tighten the HV coil fasteners to the specified torque

12. To the throttle control position sensor

13. Rear LH turn indicator connector

14. LH rear headlight assembly connector

15. Saddle opening actuator connector

16. Licence plate light connector

17. Insert the clamp on the wiring harness in the hole on the chassis

18. Canister solenoid valve connector

19. Tighten the fastening instruments of the control unit anchoring bracket to the specified torque

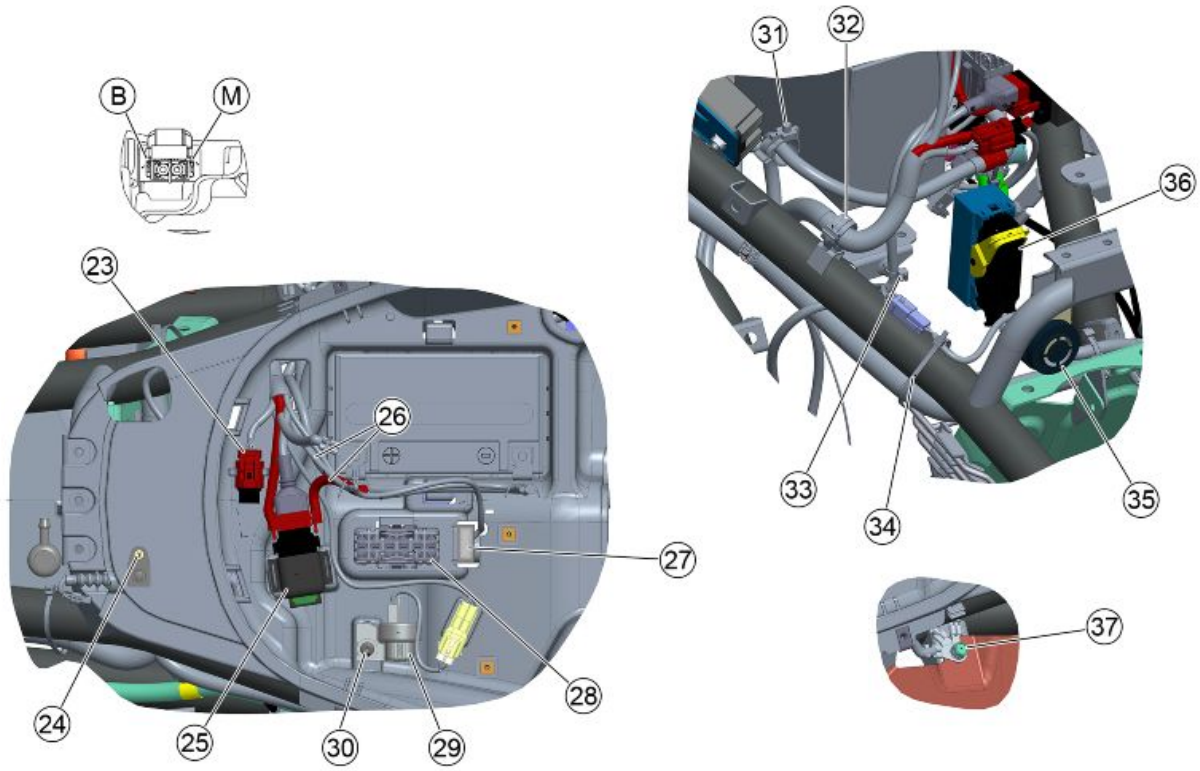
20. Tighten the branch of the fuses to the ABS control unit box with a clamp

21. Tighten the fastening instruments of the ABS control unit ground to the specified torque

22. Engine earth braid

Locking torques (N*m)

H.V. coil. 6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft) Control unit anchoring bracket 6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft) ABS control unit ground 7,5 ÷ 9,5 Nm (5.5 ÷ 7 lbf*ft)



23. OBD socket

24. Tighten the fastening instruments of the helmet compartment lighting button to the specified torque

25. Starter relay

26. **IMPORTANT: IMPROPER ASSEMBLY/ROUTING OF THESE CABLES CAN LEAD TO FIRE ON THE VEHICLE AND/OR DAMAGE TO THE DRIVER**

27. Fuse No. 13

28. Secondary fuses "**A**"

29. Fall sensor

30. Tighten the fastening instruments of the fall sensor to the specified torque

31. Tighten with a clamp on the helmet compartment

32. Clamp

33. Insert the clamp on the wiring harness in the hole on the chassis

34. Lock with a clamp

35. Reverse gear buzzer

36. ABS control unit connector (**after connection, check that the yellow lever is locked upwards)**)

37. Tighten the fastening instruments of the chassis ground to the specified torque

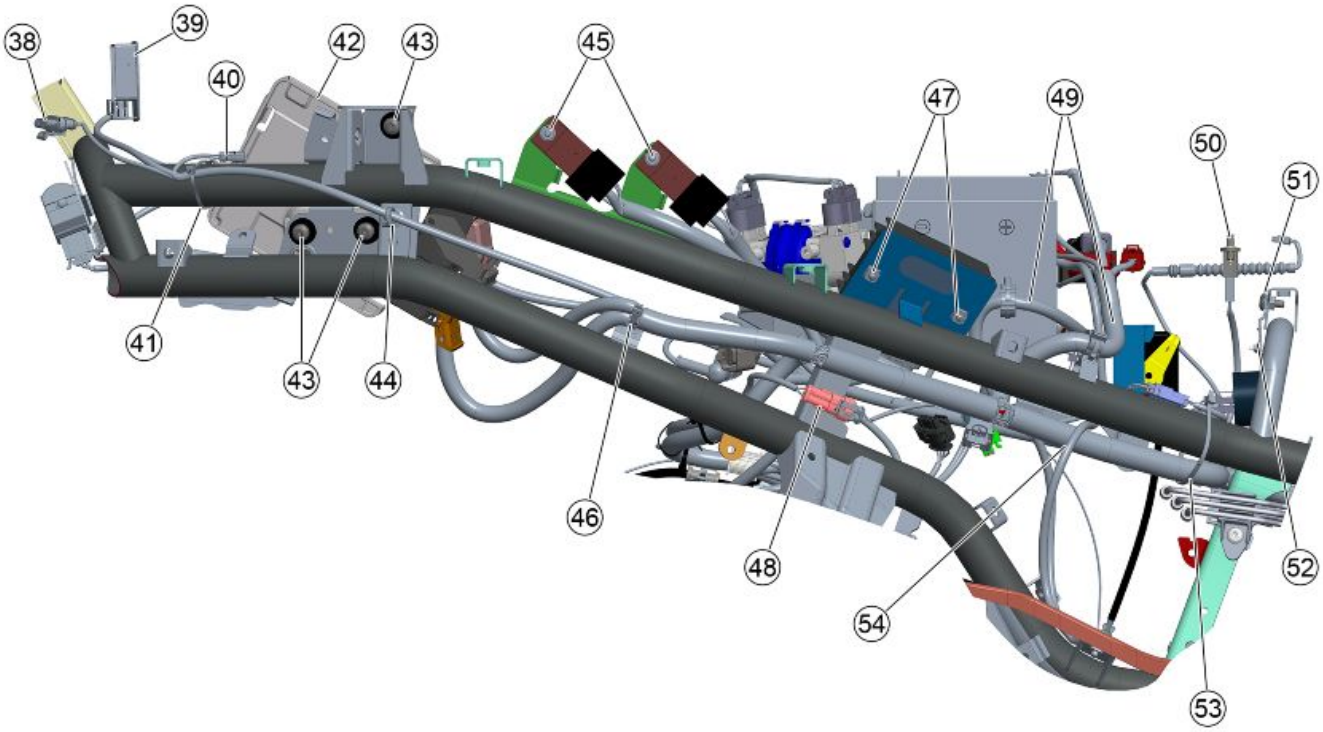
STARTER RELAY POSITIVE CABLES

B. In correspondence with the letter "**B**", tighten the cable with **BLACK** heat shrink

M. In correspondence with the letter "**m**", tighten the cable with **RED** heat shrink

Locking torques (N*m)

Helmet compartment light switch 1 ÷ 1,7 Nm (0.7 ÷ 1.3 lbf*ft) Fall sensor 1 ÷ 1,7 Nm (0.7 ÷ 1.3 lbf*ft) Frame ground 7,5 ÷ 9,5 Nm (5.5 ÷ 7 lbf*ft) Starter relay positive cables 4 - 6 Nm (3 -4.4 lb*ft)



38. RH rear headlight assembly connector

39. Helmet compartment internal light

40. Rear RH turn indicator connector

41. Lock with a clamp

42. After fixing the injection control unit, tighten it with the appropriate belt

43. Injection ECU fastening

44. Insert the clamp on the wiring harness in the hole on the chassis

45. Tighten the fastening instruments of the relays to the specified torque

46. Insert the clamp on the wiring harness in the hole on the chassis

47. Voltage regulator fastenings

48. Pick-up connector

49. **IMPORTANT: IMPROPER ASSEMBLY/ROUTING OF THESE CABLES CAN LEAD TO FIRE ON THE VEHICLE AND/OR DAMAGE TO THE DRIVER**

50. Helmet compartment light switch

51. Tighten the fastening instruments of the bracket to the specified torque

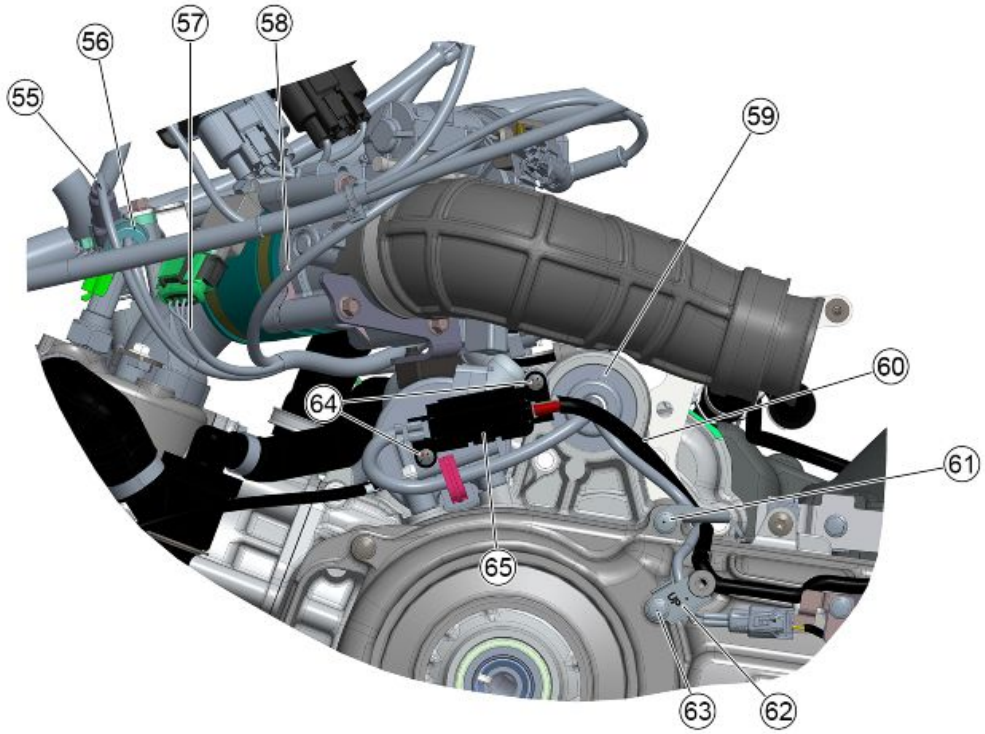
52. Tighten the fastening instruments of the reverse gear buzzer to the specified torque

53. **Position the clamp so as the wiring harness and pipes of the ABS system do not come into contact**

54. Pass the ground cable between frame and main harness

Locking torques (N*m)

Reverse gear relays 6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft) Reverse gear buzzer support bracket 6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft) Reverse gear buzzer 1,5 ÷ 2,5 Nm (1.1 ÷ 1.8 lbf*ft)



55. To the injector

56. To the engine temperature sensor

57. To the T-Map sensor

58. To the throttle body

59. The cable gland on the wiring harness must be inside the engine support

60. Reverse gear positive cable

61. Tighten the fastening instruments of the bracket to the specified torque

62. The word "UP" must remain visible

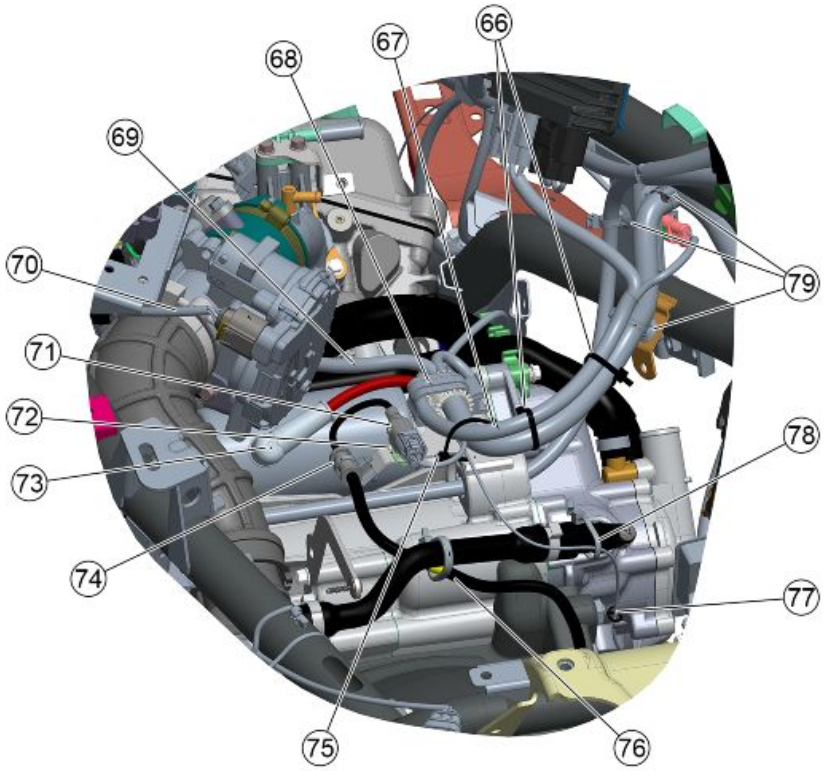
63. Tighten the fastening instruments of the bracket to the specified torque

64. Tighten the fastening instruments of the shunt connection support to the specified torque

65. Tighten the fastening instruments of the shunt connection to the specified torque

Locking torques (N*m)

Reverse gear cable unit upper bracket 11 ÷ 13 Nm (8.1 ÷ 9.6 lbf*ft) Reverse gear cable unit lower bracket 6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft) Shunt connection support 3 ÷ 3,5 Nm (2.2 ÷ 2.6 lbf*ft) Shunt connection 4 - 6 Nm (3 -4.4 lb*ft)



66. Lock with a clamp

67. Flywheel cables

68. Clamp

69. Pass under the induction fitting sleeve

70. To the throttle body

71. Rear ABS sensor connector

72. Clamp

73. Tighten the fastening instruments of the starter motor positive cable to the specified torque

74. Clamp

75. Tighten the flywheel wiring harness to the vehicle main wiring harness and to the bracket on the engine using a clamp

76. Tighten the rear ABS sensor cable to the pipe in correspondence with the yellow taping using a clamp

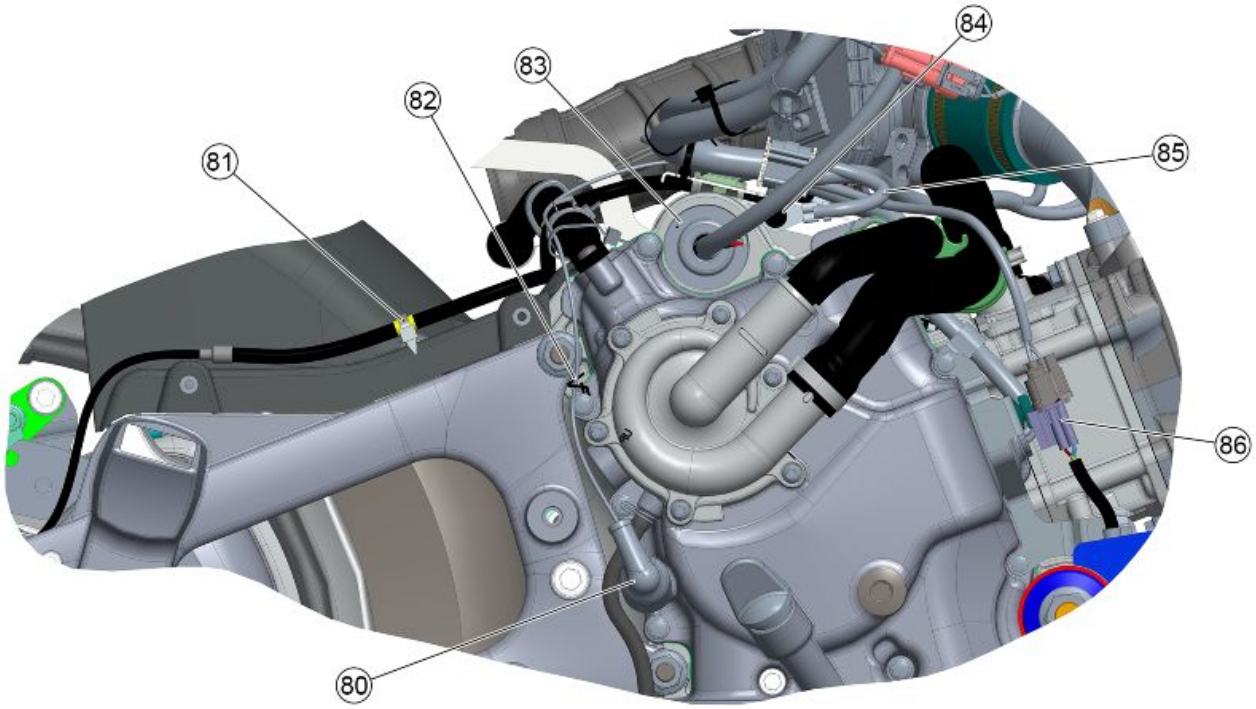
77. Pass the engine oil pressure sensor cable through the clamp

78. Lock with a clamp

79. Insert the clamp on the wiring harness in the hole on the chassis

Locking torques (N*m)

Starter motor positive cable 6 ÷ 8 Nm (4.4 ÷ 5.9 lbf*ft)



80. Engine oil pressure sensor

81. Fasten the cable of the rear ABS sensor with a clamp on the yellow taping

82. Pass the engine oil pressure sensor cable in the clamp

83. The cable gland on the wiring harness must be inside the engine support

84. Tighten the engine ground cable fastening to the specified torque

85. Engine ground lead

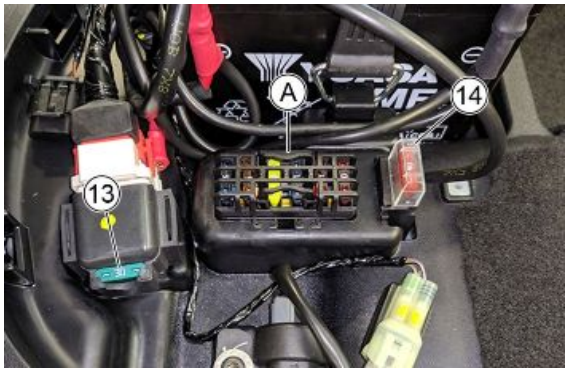
86. Lambda probe connector

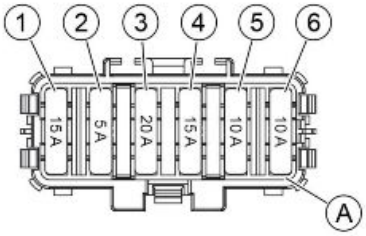
Locking torques (N*m)

Engine ground lead 7,5 ÷ 9,5 Nm (5.5 ÷ 7 lbf*ft)

Fuses

The electrical system has 14 fuses for protection of different system circuits divided into two single fuses («**13**» and «**14**») and two fuse holders.
The fuses «**13**», «**14**» and the first box, «**A**», are placed inside the battery compartment while the second box, «**B**», is inside the foot board on the left side of the vehicle.
The following table shows the characteristics of the fuses in the vehicle.





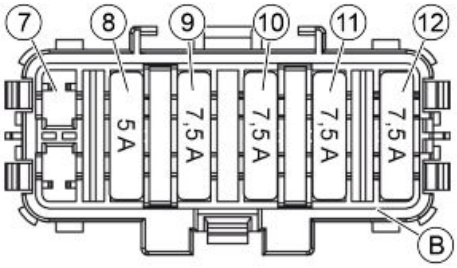
MAIN FUSES TABLE

	Specification	Desc./Quantity
1	Fuse no. 13	**Capacity**: 30 A **Protected circuits**: Battery recharge. **Protected circuits (key-on power)**: fuses No.s. 8, 9, 10 and 11.
2	Fuse no. 14	**Capacity**: 40 A **Protected circuits**: ABS ECU.

FUSE BOX "A" TABLE

	Specification	Desc./Quantity
1	Fuse no. 1	**Capacity**: 15 A **Protected circuits**: Pre-installation of heated grips and seat.
2	Fuse no. 2	**Capacity**: 5 A **Protected circuits**: instrument panel.
3	Fuse no. 3	**Capacity**: 20 A **Protected circuits**: parking electronic control unit.
4	Fuse no. 4	**Capacity**: 15 A **Protected circuits**: High beam / low beam light (via relay), accessories and PMP3 pre-installation, turn indicator control device, saddle opening (via relay), helmet compartment lighting, OBD socket. **Protected circuits (key-on power)**: fuse n° 12, saddle opening button.
5	Fuse no. 5	**Capacity**: 10 A **Protected circuits**: electric fan (via relay).
6	Fuse no. 6	**Capacity**: 10 A **Protected circuits**: injection loads (via relay), injection control unit, injection loads relay, fuel pump, reverse gear solenoid unit.

To reach the box «**B**», remove the plastic cover after unscrewing the screw indicated in the picture.



FUSE BOX "B" TABLE

	Specification	Desc./Quantity
1	Fuse no. 7	**Capacity**: - **Protected circuits**: -
2	Fuse no. 8	**Capacity**: 5 A **Protected circuits (key-on power)**: stop lights (via relay), stop lights relay, starter relay.
3	Fuse no. 9	**Capacity**: 7.5 A **Protected circuits (key-on power)**: High beam flashing switch, horn.
4	Fuse no. 10	**Capacity**: 7.5 A **Protected circuits (key-on power)**: engine stop relay, starter button, ABS control unit, immobilizer antenna, injection control unit, emergency stop switch (RUN/OFF).
5	Fuse no. 11	**Capacity**: 7.5 A **Protected circuits (key-on power)**: DRL, parking lights, licence plate light, headlamp relay, horn (via relay), horn relay, parking control unit, warning lights unit, instrument cluster.
6	Fuse no. 12	**Capacity**: 7.5 A **Protected circuits (key-on power)**: instrument cluster, heated hand grips and seat pre-installation, accessories and PMP3 pre-installation, flashers switch, turn indicator control device, hazard button, OBD socket, USB port.

CAUTION

ELIMINATE THE CAUSE OF THE FAULT BEFORE REPLACING THE FUSE.
WE STRONGLY RECOMMEND THAT YOU CONTACT AN AUTHORISED SERVICE CENTRE.

CAUTION

IN ORDER TO AVOID DAMAGING THE ELECTRIC SYSTEM, NEVER DISCONNECT THE WIRING WHILE THE ENGINE IS RUNNING.

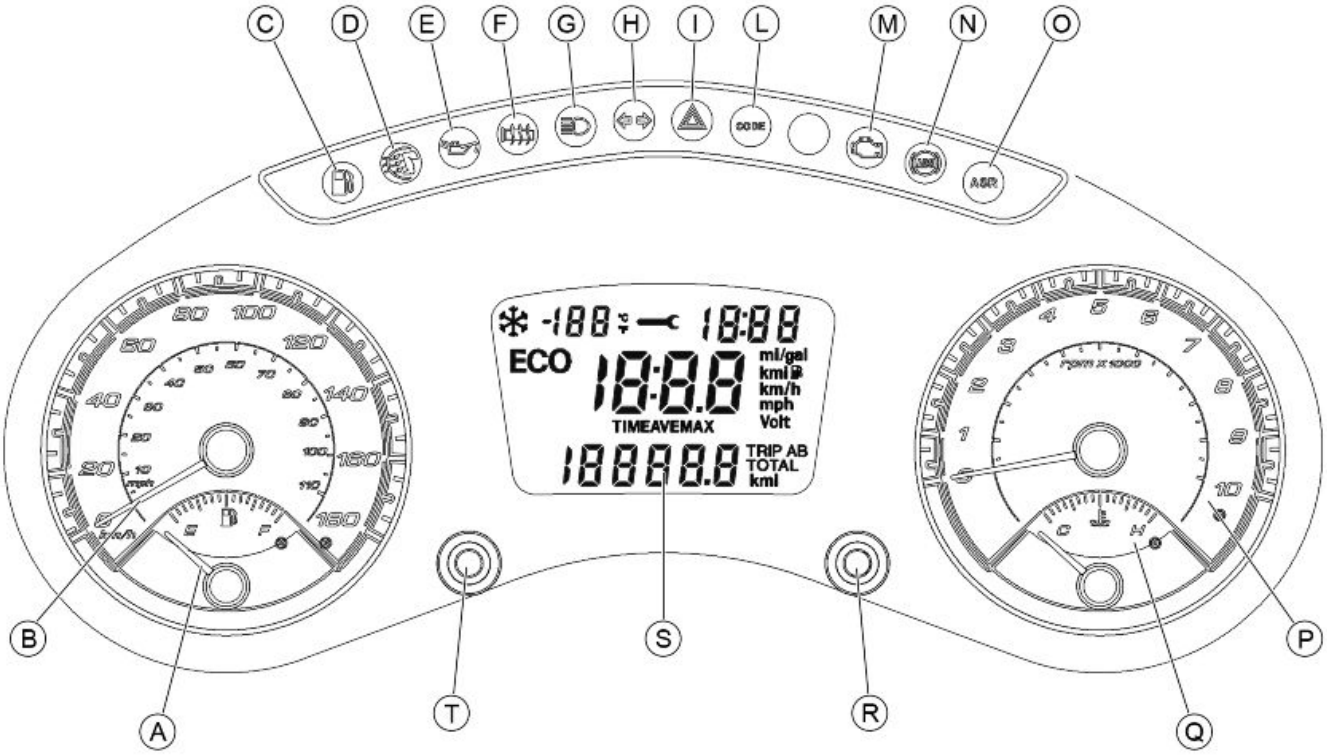
CAUTION

MODIFICATIONS OR REPAIRS TO THE ELECTRICAL SYSTEM, PERFORMED INCORRECTLY OR WITHOUT STRICT ATTENTION TO THE TECHNICAL SPECIFICATIONS OF THE SYSTEM CAN CAUSE MALFUNCTIONING AND RISK OF FIRE.

CAUTION

PROCEED WITH CAUTION.
DO NOT DAMAGE THE TABS AND/OR THEIR CORRESPONDING SLOTS. HANDLE THE PLASTIC AND PAINTED COMPONENTS WITH CARE, DO NOT SCRATCH OR IMPAIR THEM.

Dashboard



A = Fuel level indicator

B = Speedometer

C = Low fuel warning light

D = Leg warmer warning light (where provided)

E = Engine oil warning light

F = Heated hand grips indicator light (where provided)

G = High beam warning light

H = Turn indicator warning light

I = Hazard warning light

L = CODE warning light (immobilizer)

M = MIL warning light (Malfunction Indicator Lamp)

N = ABS warning light

O = ASR warning light

P = Engine rpm indicator

Q = Coolant liquid temperature indicator

R = SET button

S = Digital display

T = ODO/TRIP button

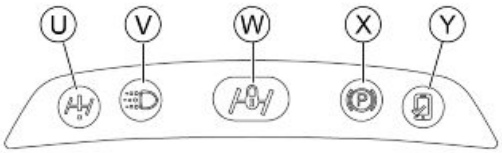
U = Front suspension lock system malfunction warning light

V = DRL warning light

W = Front suspension lock system warning light

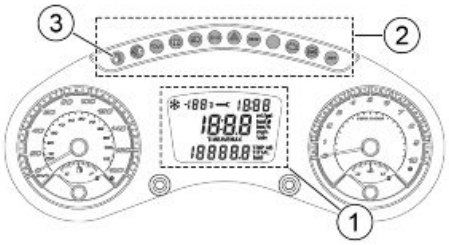
X = Parking brake warning light

Y = Multimedia System warning light (PMP-PIAGGIO MIA)



When the ignition switch is set to «**ON**»:

- All the functions on the digital display «**1**» light up;
- All the warning lights «**2**» on the instrument panel light up;
- The low fuel warning light «**3**» remains on for two seconds, then it has the normal function to indicate when the reserve in the tank is reached;
- The needles move to the full scale and back and then they are placed on the value to be displayed.

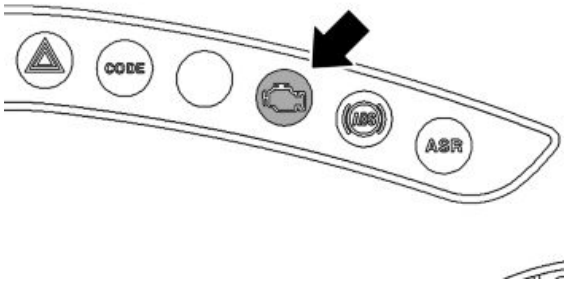


The digital display can be divided into five main zones, within which the functions and settings are developed:

- temperature indication and ice warning «**4**»;
- maintenance icon «**5**»;
- clock «**6**»;
- information about speed, instantaneous and average travel, autonomy and battery voltage «**7**»;
- distance information «**8**» related to the functions «**TOTAL**», «**TRIP A**» and «**TRIP B**».

MIL warning light (Malfunction Indicator Lamp)

The warning light indicates possible anomalies detected by the engine control unit. After the check before switching to «**ON**», the warning light, in case of anomaly, has two different indication modes:



- WARNING LIGHT ON STEADY

A defect is detected that could affect/degrade the engine performance.

- LIGHT FLASHING

A defect is detected that could affect the safety of the driver, therefore the engine performance is intentionally degraded.

SETTING THE UNITS OF MEASUREMENT

Press and hold down for at least 3 seconds the "**MODE**" button and at the same time turn the starter key to "**ON**".

The icons "**kmi**" and "**°C-°F**" will begin to flash.

"**Kmi**" represents the combination of "**km**" (kilometres) and "**mi**" (miles).

By pressing the "**MODE**" button for less than a second the icons "**km**" e "**mi**" are selected in sequence.

Press and hold down for at least 3 seconds the **SET**" button to confirm your choice.

Now the icon indicating the outside temperature "**°C-°F**" will flash.

By pressing the "**MODE**" button for less than a second the icons " **°C**" and " **°F**" are selected in sequence.

Press and hold down for at least 3 seconds the **SET**" button to confirm your choice.

Multimedia System PMP-PIAGGIO MIA

Download and install the specific «**PIAGGIO**» app from the Play Store or Apple Store on your smartphone.

PAIRING PROCEDURE Smartphone - Multimedia System PMP-PIAGGIO MIA

The SPORT version vehicle is equipped as standard with the "**Piaggio MIA**" ECU (optional equipment on the other versions), which communicates with the smartphone via Bluetooth. Using the specific "**Piaggio**" application installed on the smartphone, it is possible to exchange data with the vehicle and manage multimedia contents. Once a connection is established correctly between the control unit and the smartphone, the following functions can be directly managed by the digital display of the vehicle:

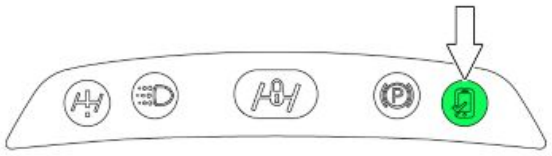
- manage phone calls;
- manage audio playback;
- notifications management;

To enable the functions of the multimedia system, it is necessary to pair the device on the vehicle with the smartphone performing the following procedure:

- With the ignition key in "OFF" position, keep the CONNECTIVITY button pressed;

- **Turn the ignition key to the "IGNITION" position while keeping pressed the CONNECTIVITY button** and **wait for the green icon** of the PMP-PIAGGIO MIA Multimedia System on the instrument cluster to flash;

- **Release the button as soon as the** "PMP-PIAGGIO MIA Multimedia System" light starts flashing;
- At this point **enable the Bluetooth search on your smartphone**;
- **Select the device "BT-ROUTER" or "PMP3-XXXX"** (depending on the country of destination the device may have a different Bluetooth name) and, **if requested**, **enter the password "0000"** to complete the Smartphone - Piaggio MIA pairing.
- **The connection between Smartphone and vehicle** will be indicated **by the illumination of the green icon** on the instrument cluster.



For specific information about the pairing of the "Piaggio MIA" system and for any differences in the procedure depending on the type of smartphone used, please refer to the user manual included in the "PIAGGIO" app.
Please note that the installation and connection of the app are ESSENTIAL for using the system.
The app manual with specific information for using the system is available by visiting the site

www.app.piaggio.com

The paired device will be present in the list of paired devices. Wait for the "Piaggio MIA" system to automatically connect the smartphone. **Do NOT force the connection from the telephone. When requested, allow phone book and notifications sharing. These authorizations are required to manage calls from the handlebar and view the SMS reception notification.**

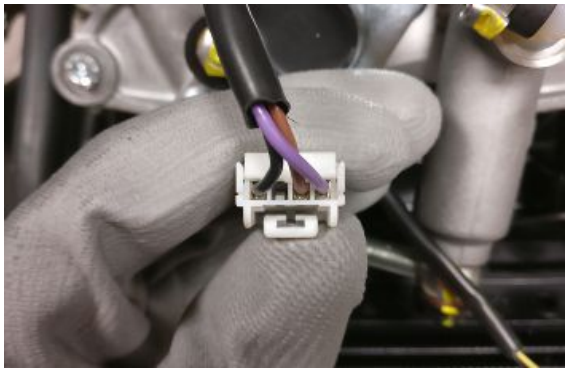
THE SUCCESSFUL CONNECTION BETWEEN THE SMARTPHONE AND VEHICLE WILL BE INDICATED BY THE SMARTPHONE ICON LIGHTING UP ON THE INSTRUMENT CLUSTER. REFER TO THE "PIAGGIO" APP MANUAL FOR INFORMATION ABOUT THE MEANING OF THE ICON FLASHING ACCORDING TO THE SYSTEM'S OPERATING MODES.

Connectors

CAUTION

N.B.

THE DIAGRAM SHOWS THE LAYOUT OF THE CONNECTORS VIEWED FROM THE CABLE INLET SIDE, AS INDICATED IN THE EXAMPLE.



The electrical components of the vehicle are as follows:

- Immobilizer antenna
- Saddle opening actuator
- Battery
- H.V. coil.
- Reverse gear buzzer
- ABS control unit
- Parking control ECU
- Injection ECU
- PMP3 control unit
- Horn
- Ignition switch
- Turn signal selector
- Light switch
- Throttle body
- Engine stop switch
- Light switch
- Turn indicator control device
- Electric fan

- Right taillight
- Left taillight
- Parking brake
- Reverse gear actuator unit
- Warning light unit
- Instrument panel
- License plate light
- Injector
- Helmet compartment light switch
- Front right indicator
- Front left indicator
- Rear right indicator
- Rear left indicator
- Saddle compartment light
- Frame-engine ground
- Frame ground
- Gear motor
- Starter motor
- Reverse gear motor
- Pick-up
- Fuel pump
- Accessories pre-installation
- Setting for heated hand-grips and leg warmer
- OBD socket
- USB port
- Headlight
- Saddle release switch
- ASR Button
- Starter button
- Tilting system locking - unlocking button
- Horn button
- Connectivity button
- Hazard button
- MODE button
- Right stop button
- Left stop button
- Brake pedal stop button
- Voltage regulator

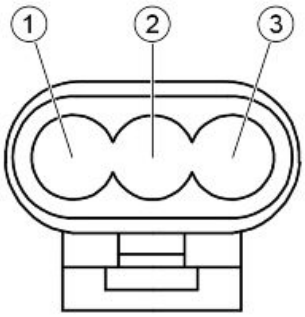
- Drive / Reverse mode selector
- Right front ABS sensor
- Left front ABS sensor
- Rear ABS sensor
- Fall sensor
- Brake calliper sensor
- Throttle grip position sensor
- Rider detection sensor
- Pressure sensor
- Oil pressure sensor
- Rotation sensor
- External temperature sensor
- Engine temperature sensor
- T-Map sensor
- Right speed sensor
- Left speed sensor
- Lambda probe
- Engine stop remote control switch
- Saddle opening actuator relay
- Starter relay
- Horn relay
- Reverse gear enable relay
- Electric fan relay
- Injection relay
- Stop lights relay
- Reverse gear motor relay
- Fuel pump relay
- Headlight relay
- Solenoid relay
- Fuel level transmitter
- Canister valve

IMMOBILIZER ANTENNA CONNECTOR

1. Live supply (Orange-Blue)

2. Ground lead (Black)

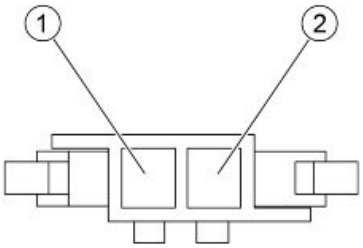
3. Serial line (Orange-White)



SADDLE OPENING ACTUATOR CONNECTOR

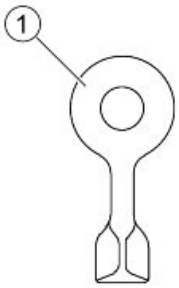
1. Ground lead (Black)

2. Power supply (Yellow-Grey)

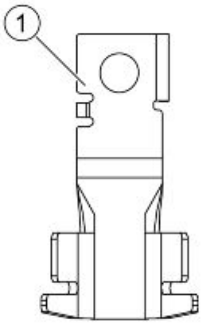


BATTERY POSITIVE

1. Power supply (Red)

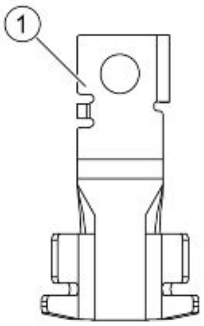


1. Power supply (Red)



BATTERY NEGATIVE

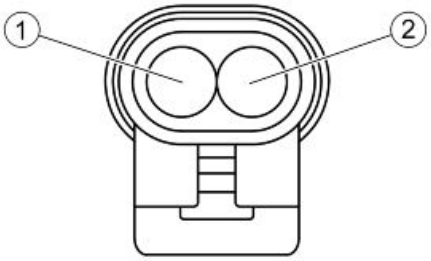
1. Ground lead (Black)



H.V. COIL CONNECTOR

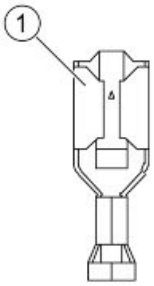
1. Injection ECU (Pink-Black)

2. Injection load relay (Black-Green)



H.V. COIL GROUND

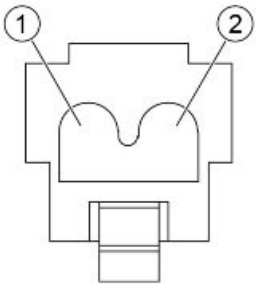
1. Ground lead (Black)



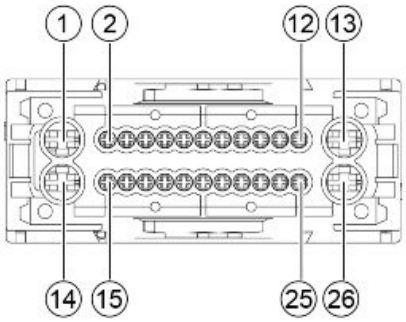
REVERSE GEAR BUZZER CONNECTORS

1. Injection ECU (Blue)

2. Power supply from injection relay (Black-Purple)



ABS CONTROL UNIT CONNECTOR



1. Battery-powered (Red)

2. Rear ABS sensor ground (Brown-Black)

3. Rear ABS sensor signal (Brown-Red)

4. Not connected

5. Front right ABS sensor signal (Purple-Red)

6. Front right ABS sensor ground (Purple-Black)

7. Not connected

8. Front left ABS sensor ground (Sky blue-Black)

9. Front left ABS sensor signal (Sky blue-Red)

10. ABS warning light (Orange)

11. Not connected

12. Not connected

13. Not connected

14. Not connected

15. Not connected

16. Not connected

17. Not connected

18. Line K (Orange-Black)

19. Not connected

20. Live supply (Orange-Blue)

21. CAN L Line (Pink-White)

22. Not connected

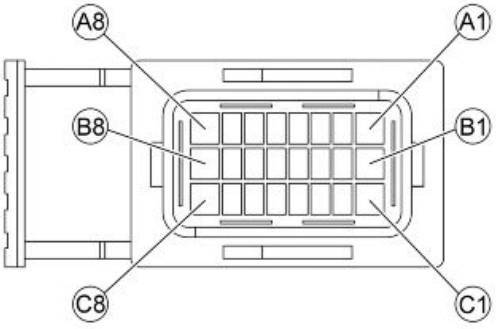
23. CAN H line (Pink-Red)

24. Not connected

25. Not connected

26. Ground lead (Black)

PARKING CONTROL ECU CONNECTOR



1A. Potentiometer power supply (Orange-Blue)

2A. CAN L Line (Pink-White)

3A. Warning light power supply (Yellow-Green)

4A. Roll lock activated warning light (Pink-Black)

5A. Roll lock system failure warning light (Grey-Black)

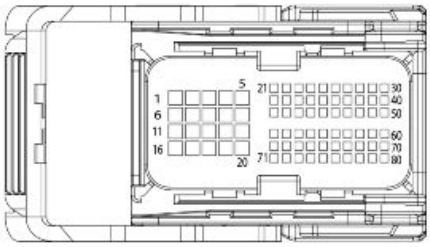
6A. Headlight relay (White-Black)

7A. Potentiometer ground lead, wheels and engine speed sensor, rider detection sensor (Yellow-Grey)
8A. Ground lead (Black)
1B. Key powered (Yellow-Red)
2B. CAN H line (Pink-Red)
3B. Left wheel speed sensor (Green)
4B. Right wheel speed sensor (Red)
5B. Potentiometer signal (Green-Blue)
6B. Suspension locking/unlocking button (Green-Grey)
7B. Horn relay for alarm (White)
8B. Gear motor (Yellow)
1C. Battery powered (Blue-Red)
2C. Line K (Orange-Black)
3C. Suspension locking/unlocking button (Yellow-Blue)
4C. Brake calliper sensor (Brown)
5C. Suspension locking/unlocking button (Purple-Black)
6C. Rider detection sensor (Purple)
7C. Vehicle speed signal (Sky blue)
8C. Gear motor (Blue)

INJECTION ECU CONNECTOR (GROUND)

1. Ground (Black-Red)

INJECTION ECU CONNECTOR (ENGINE)



1. Throttle body (Grey-Black)

2. Not connected

3. Not connected

4. Not connected

5. Canister (White - Black)

6. Throttle body (Red-Blue)

7. Not connected

8. Not connected

9. Not connected

10. Lambda probe heater (White-Blue)

11. Not connected

12. Not connected

13. Not connected

14. Not connected

15. Injector (Red-Yellow)

16. Not connected

17. H.V. coil. (Pink-Black)

18. Not connected

19. Not connected

20. Not connected

21. Not connected

22. Throttle body (Orange-White)

23. Lambda probe () (Light Blue-Black)

24. Lambda probe (+) (Green-Blue)

25. Not connected

26. Not connected

27. Not connected

28. MIL warning light (White-Brown)

29. Reverse gear solenoid relay (Light blue-Red)

30. Immobilizer warning light (Yellow)

31. Not connected

32. Not connected

33. Not connected

34. Not connected

35. Not connected

36. Not connected

37. Not connected

38. Reverse gear buzzer (Blue)

39. Not connected

40. ASR indicator light (Brown-Blue)

41. Not connected

42. Not connected

43. Not connected

44. Ground sensors (Grey-Green)

45. Not connected

46. Sensors ground (Black-Yellow)

47. Not connected

48. Not connected

49. Reverse gear motor relay (White-Purple)

50. Not connected

51. Throttle body (Green-Orange)

52. Not connected

53. Not connected

54. Sensors power supply (Brown-Red)

55. Not connected

56. Not connected

57. Sensors power supply (Red-Green)

58. Not connected

59. LH Stop button (White-Grey)

60. Pick-up (+) (Red)

61. Not connected

62. Not connected

63. T-MAP sensor (temperature) (Yellow-Blue)

64. Not connected

65. Not connected

66. Not connected

67. Sensors supply (Red-Black)

68. Not connected

69. Not connected

70. Pick-up (-) (Brown)

71. T-MAP sensor (pressure) (Yellow-Green)

72. Not connected

73. Engine temperature sensor (Light blue-Green)

74. Not connected

75. Ground sensors (Grey-Brown)

76. Not connected

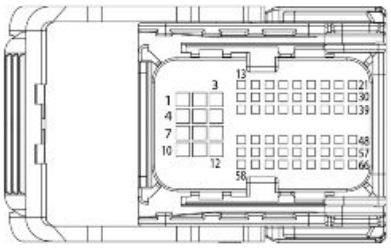
77. Not connected

78. ASR button (Light Blue-White)

79. Not connected

80. Not connected

INJECTION ECU CONNECTOR (VEHICLE)



1. Battery positive from injection load relay (Black-Green)

2. Battery positive from injection load relay (Black-Green)

3. Battery powered (Red-Green)

4. Battery positive from injection load relay (Black-Green)

5. Ground lead (Black)

6. Ground lead (Black)

7. Not connected

8. Ground lead (Black)

9. Not connected

10. Reverse gear enable relay (Blue)

11. Stop lights relay (Green-White)

12. Not connected

13. Live supply (Orange-Blue)

14. Not connected

15. Starter button (Purple)

16. Starter relay (Red)

17. Engine stop switch (Grey)

18. Injection load relay (Black-Purple)

19. Instrument panel (Green)

20. Electric fan relay (White)

21. Immobilizer antenna (Orange-White)

22. Not connected

23. Brake pedal stop button (White-Grey)

24. Not connected

25. Drive / Reverse mode selector (D) (Light blue)

26. Engine stop relay (Yellow-Blue)

27. Not connected

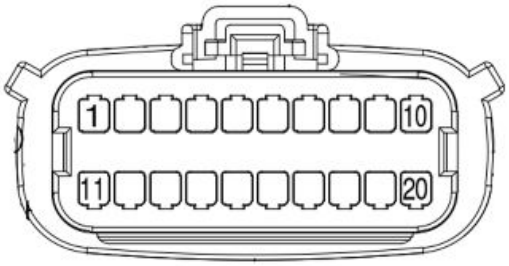
28. Not connected

29. MIL warning light (Brown-Yellow)
30. Not connected
31. Drive / Reverse mode selector (R) (Grey-Black)
32. RH stop button (Pink-Green)
33. Not connected
34. Not connected
35. Not connected
36. Not connected
37. Not connected
38. Fuel pump relay (Purple-Black)
39. Not connected
40. Not connected
41. Not connected
42. Sensors ground (Light Blue-Black)
43. Sensors ground (Brown-Black)
44. Sensors ground (Black-Yellow)
45. Not connected
46. Not connected
47. Not connected
48. CAN H line (Pink-Red)
49. Reverse gear actuator unit (Brown)
50. Sensors power supply (Light blue-Red)
51. Sensors power supply (Brown-Red)
52. Sensors power supply (Light blue-Green)
53. Ground sensors (Grey-Green)
54. Not connected
55. Not connected
56. Not connected
57. CAN L Line (Pink-White)
58. Not connected
59. Throttle grip position sensor (Light blue-White)
60. Throttle grip position sensor (Light blue-Yellow)
61. Throttle grip position sensor (Brown-White)
62. Fall sensor (Orange-Green)
63. Not connected
64. Not connected

65. Starter relay (Purple-White)

66. Ground (Black-Red)

PMP3 CONTROL UNIT CONNECTOR



1. CAN H line (Pink-Red)

2. Ignition switched live (Yellow-Black)

3. Saddle opening actuator relay (Blue-Yellow)

4. Multimedia System warning light PMP-PIAGGIO MIA (Pink-Green)

5. DRL signal (Yellow)

6. Right turn indicators control outlet (White-Blue)

7. Left turn indicators control outlet (Pink)

8. Horn signal (Yellow-Pink)

9. Battery-powered (Blue)

10. Not connected

11. CAN L Line (Pink-White)

12. Not connected

13. Multimedia System warning button PMP-PIAGGIO MIA (Green)

14. LH indicators signal input (White-Pink)

15. RH indicators signal input (Grey-Blue)

16. Helmet compartment lighting signal (Blue-Black)

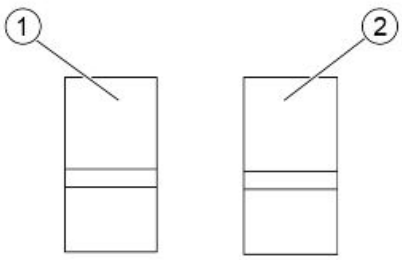
17. High beam lights signal (Pink)

18. Fuel level indicator (White-Green)

19. Ground lead (Black)

20. Not connected

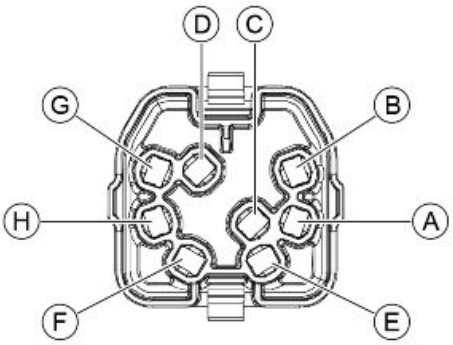
HORN CONNECTORS



1. Ground lead (Black)

2. Power supply (Yellow-Pink)

IGNITION SWITCH CONNECTOR



A. Battery Positive (Red-Black)

B. Ignition switched live (Orange)

C. Not connected

D. Not connected

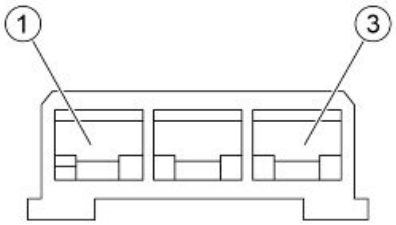
E. Ignition switched live (Pink-Black)

F. Battery positive (Blue)

G. Ignition switched live (White)

H. Battery positive (Blue)

TURN INDICATORS SWITCH CONNECTOR

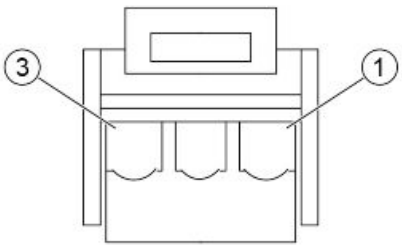


1. LH indicators (White-Pink)

2. RH turn indicators (Grey-Blue)

3. Power supply (Yellow-Black)

LIGHT SWITCH CONNECTOR



1. Ignition switched live (Yellow-Red)

2. Daylight running light (DRL) (Yellow)

3. Parking light (Yellow-Black)

THROTTLE BODY CONNECTOR

1. TPS 1 signal (Orange-White)

2. Power supply from injection control unit (Red-Black)

3. Throttle body + (Red-Blue)

4. TPS 2 signal (Green-Orange)

5. Throttle body - (Grey-Black)

6. Negative from the injection control unit (Black-Yellow)

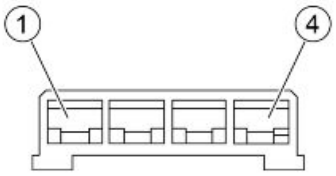
ENGINE STOP SWITCH CONNECTOR

1. Not connected

2. Engine stop relay (Orange-Light blue)

3. Signal for control unit (Grey)

4. Negative from control unit (Black-Yellow)



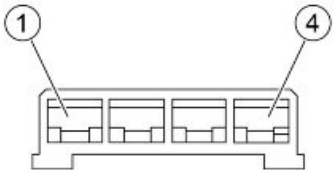
LIGHT SWITCH CONNECTOR

1. Ignition switched live (Light blue)

2. Low beam light (Brown)

3. Ignition switched live (Yellow-Red)

4. High-beam light (Purple)



TURN INDICATOR CONTROL DEVICE CONNECTOR

1. Hazard button (Brown)

2. Left switch (White-Pink)

3. Right switch (Grey-Blue)

4. Left turn indicators (Pink)

5. Right turn indicators (White-Blue)

6. Battery-powered (Blue)

7. Hazard warning light (White-Black)

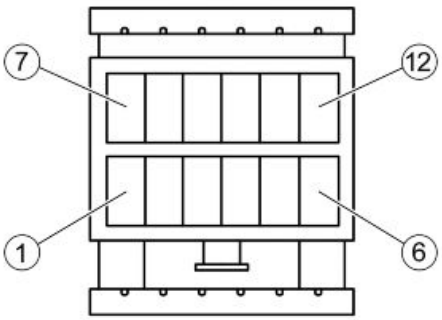
8. Key powered (Yellow-Black)

9. Ground lead (Black)

10. Not connected

11. Not connected

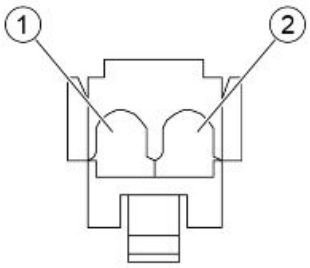
12. Not connected



ELECTRIC FAN CONNECTOR

1. Ground lead (Black)

2. Power supply (Red)

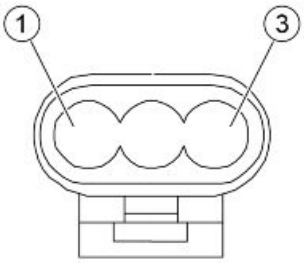


RH TAILLIGHT CONNECTOR

1. Running light (Yellow-Red)

2. Ground lead (Black)

3. Brake light (White-Black)

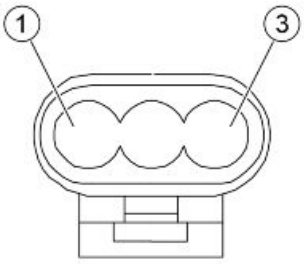


LH TAILLIGHT CONNECTOR

1. Running light (Yellow-Red)

2. Ground lead (Black)

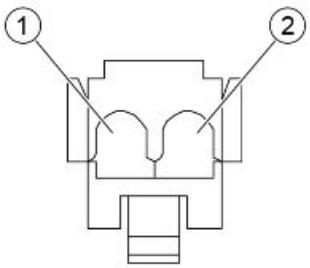
3. Brake light (White-Black)



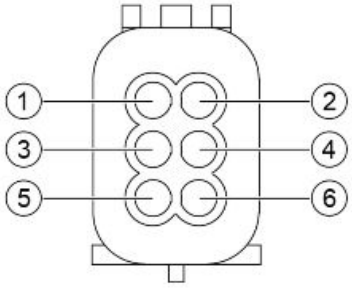
PARKING BRAKE CONNECTOR

1. Warning light control (Yellow-Grey)

2. Ground lead (Black)



REVERSE GEAR ACTUATOR UNIT CONNECTOR



1. Solenoid relay (Green)

2. Injection control unit (Brown-Red)

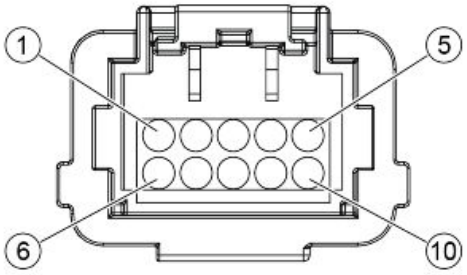
3. Ground lead (Black)

4. Negative from injector control unit (Grey-Green)

5. Not connected

6. injection ECU (Brown)

INDICATOR LIGHTS UNIT CONNECTOR



1. Tilting lock warning light (Grey-Black)

2. Tilting lock system fault warning light (Pink-Black

3. Power supply from parking command control unit (Yellow-Green)

4. Ignition switched live (Yellow-Red)

5. Ground lead (Black)

6. Daylight running light (DRL) indicator light (Yellow)

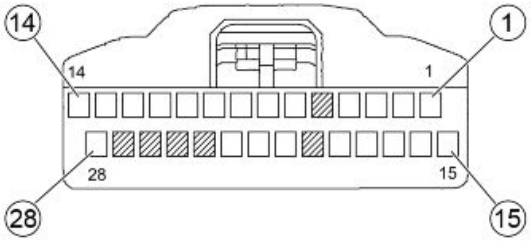
7. Multimedia system warning light (+) (Pink-Green)

8. Multimedia system warning light (-) (Black)

9. Handbrake warning light (Yellow-Grey)

10. Not connected

INSTRUMENT PANEL CONNECTOR



1. Battery-powered (Red-Blue)

2. Ignition switched live (Yellow-Red)

3. Sensors ground (Black)

4. Vehicle speed signal (Sky blue)

5. Not connected

6. Ambient temperature signal (Yellow-Blue)

7. Engine temperature signal (Sky blue-Black)

8. Fuel level indicator (White-Green)

9. High beam warning light (Purple)

10. Instrument panel lighting (Yellow - Black)

11. Left turn indicator warning light (Pink)

12. Right turn indicator warning light (White-Blue)

13. Hazard warning light (White-Black)

14. Engine oil low pressure signal (Pink-White)

15. Injection warning light (Brown-Yellow)

16. ABS warning light (Orange)

17. ASR indicator light (Brown-Blue)

18. Leg warmer warning light (Purple-White)

19. Heated hand-grips warning light (Green-Orange)

20. Not connected

21. Engine speed signal (Green)

22. ECO mode (White-Brown)

23. MODE button (Green-Blue)

24. Not connected

25. Not connected

26. Not connected

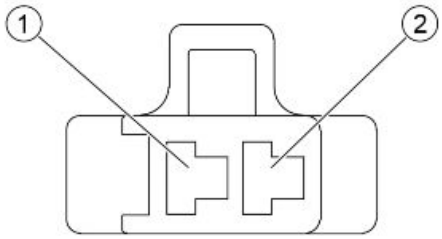
27. Not connected

28. Immobilizer LED (Yellow)

NUMBER PLATE LIGHTING CONNECTOR

1. Power supply (Yellow-Red)

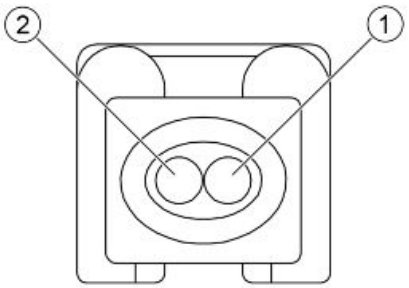
2. Ground lead (Black)



INJECTOR CONNECTOR

1. Negative from control unit (Red-Yellow)

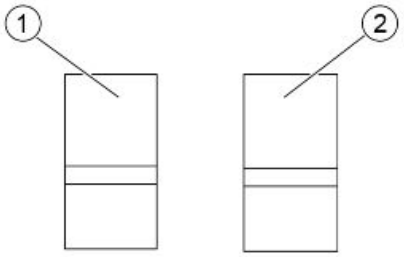
2. Power supply via fuel pump relay (Black-Green)



HELMET COMPARTMENT LIGHTING SWITCH CONNECTORS

1. Saddle compartment light (Blue-Black)

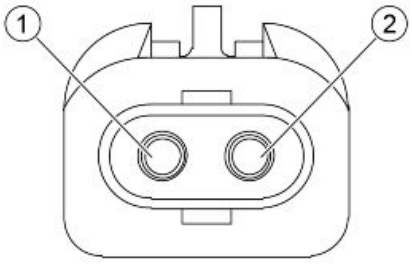
2. Power supply (Blue)



RH FRONT DIRECTION INDICATOR CONNECTOR

1. Power supply (White-Blue)

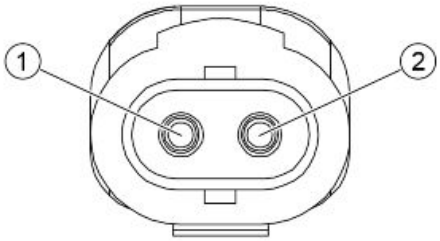
2. Ground lead (Black)



LH FRONT DIRECTION INDICATOR CONNECTOR

1. Power supply (Pink)

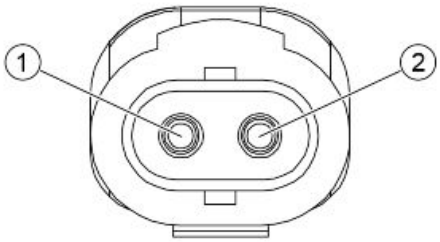
2. Ground lead (Black)



RH REAR DIRECTION INDICATOR CONNECTOR

1. Power supply (White-Blue)

2. Ground lead (Black)

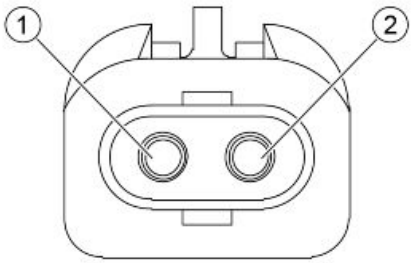


LH REAR DIRECTION INDICATOR CONNEC-

TOR

1. Power supply (Pink)

2. Ground lead (Black)

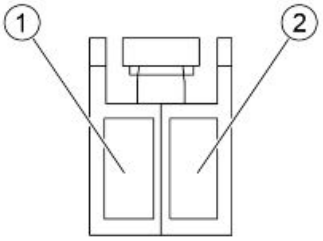


SADDLE COMPARTMENT LIGHT CONNEC-

TOR

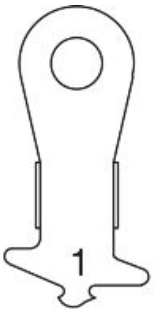
1. Power supply (Blue-Black)

2. Ground lead (Black)



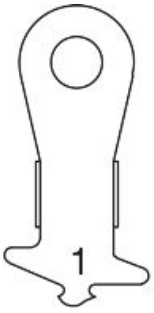
FRAME ENGINE-GROUND

1. Ground lead (Black)



FRAME GROUND

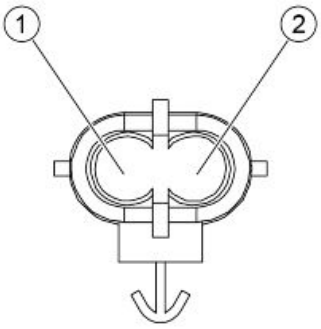
1. Ground lead (Black)



GEAR MOTOR CONNECTOR

1. Parking electronic control unit (Yellow)

2. Parking electronic control unit (Blue)

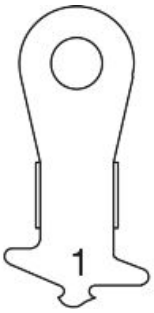


STARTER MOTOR POSITIVE

1. Power supply (Red)

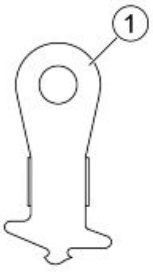
STARTER MOTOR NEGATIVE

1. Ground lead (Black)



REVERSE GEAR MOTOR POSITIVE

1. Reverse gear motor (Red)

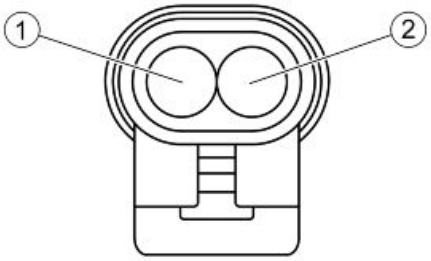


1. Reverse gear motor relay (Red)

PICK-UP CONNECTOR

1. Injection ECU (Red)

2. Injection ECU (Brown)



FUEL PUMP CONNECTOR

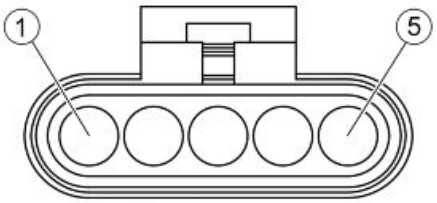
1. Injection load relay (Green)

2. Not connected

3. Not connected

4. Ground lead (Black)

5. Not connected



WIRING FOR ACCESSORIES - CONNECTOR

1. Ground lead (Black)

2. Fuel level indicator (White-Green)

3. CAN H line (Pink-Red)

4. CAN L Line (Pink-White)

5. Diagnostics (Orange-Black)

6. Saddle open signal (Blue-Black)

7. Battery-powered (Blue)

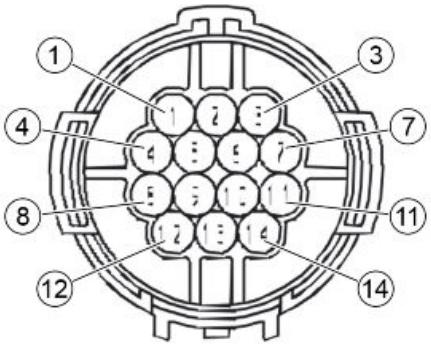
8. Ignition switched live (Yellow-Black)

9. Not connected

10. Saddle opening actuator (Yellow-Grey)

11. LH direction indicator (Pink)

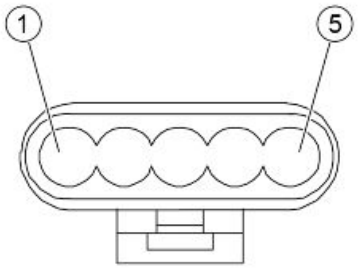
12. RH direction indicator (White-Blue)



13. High-beam light (Purple)

14. Vehicle speed signal (Sky blue)

PRE-INSTALLED HEATED HAND-GRIPS AND LEG WARMER CONNECTOR



1. Ignition switched live (Yellow-Black)

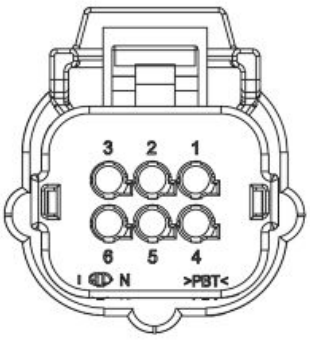
2. Ground lead (Black)

3. Battery power (Red-White)

4. Leg warmer (Purple-White)

5. Heated hand-grips (Green-Orange)

OBD SOCKET CONNECTOR



1. Ignition switched live (Yellow-Black)

2. CAN H line (Pink-Red)

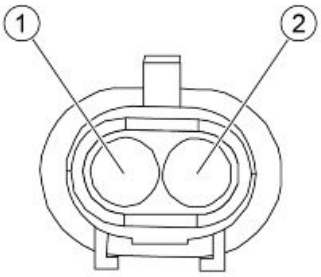
3. Ground lead (Black)

4. Battery-powered (Blue)

5. CAN L Line (Pink-White)

6. Line K (Orange-Black)

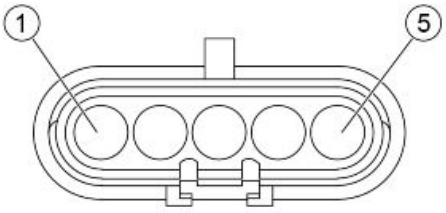
USB PORT CONNECTOR



1. Power supply (Yellow-Black)

2. Ground lead (Black)

HEADLIGHT CONNECTOR



1. Daylight running light (DRL) (Yellow)

2. Parking light (Yellow-Black)

3. Ground lead (Black)

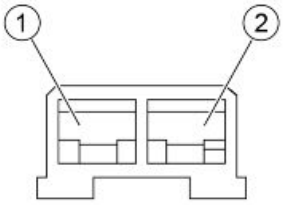
4. High-beam light (Purple)

5. Low beam light (Brown)

SADDLE OPENING BUTTON CONNECTOR

1. Saddle opening actuator (Yellow-Grey)

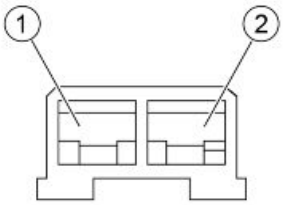
2. Power supply (Pink-Black)



ASR BUTTON CONNECTOR

1. Negative from injector control unit (Grey-Green)

2. Signal (Sky blue-White)

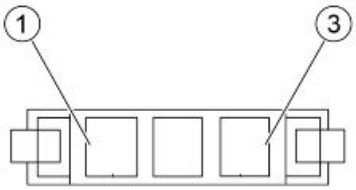


STARTER BUTTON CONNECTOR

1. Injection ECU (Purple)

2. Not connected

3. Live supply (Orange-Blue)



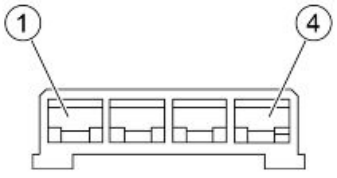
LOCK/RELEASE TILTING SYSTEM BUTTON CONNECTOR

1. Ground lead (Black)

2. Lock signal (Purple-Black)

3. Parking electronic control unit (Green-Grey)

4. Release signal (Yellow-Blue)

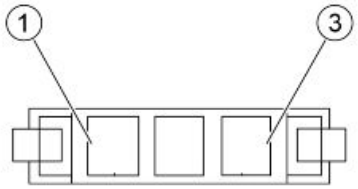


HORN BUTTON CONNECTOR

1. Power supply (Light blue)

2. Not connected

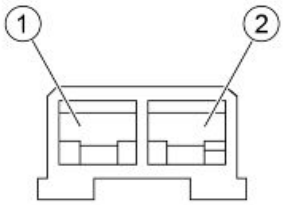
3. Horn (Yellow-Pink)



CONNECTIVITY BUTTON CONNECTOR

1. Ground lead (Black)

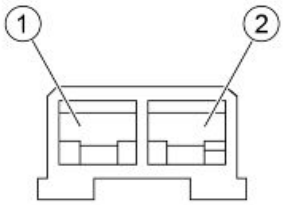
2. PMP3 control unit (Green)



HAZARD BUTTON CONNECTOR

1. Direction indicators control device (Brown)

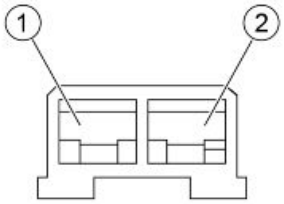
2. Power supply (Yellow-Black)



MODE BUTTON CONNECTOR

1. Ground lead (Black)

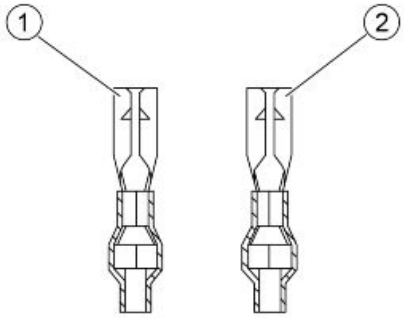
2. Instrument panel (Green-Blue)



RH STOP BUTTON CONNECTORS

1. Brake signal (Pink-Green)

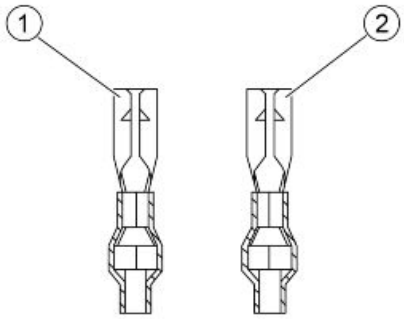
2. Power supply (Grey-Green)



LH STOP BUTTON CONNECTORS

1. Brake signal (White-Grey)

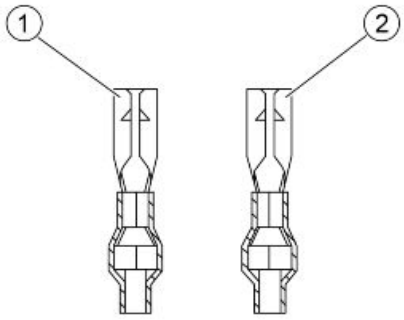
2. Power supply (Grey-Brown)



BRAKE PEDAL STOP BUTTON CONNECTORS

1. Brake signal (White-Grey)

2. Power supply (Black-Yellow)

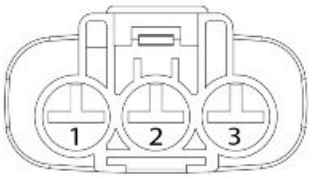


VOLTAGE REGULATOR CONNECTOR

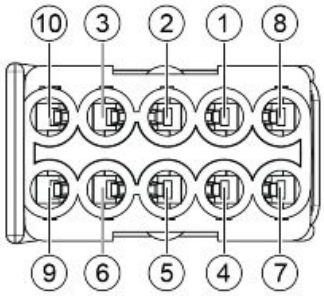
1. Battery-powered (Red-Black)

2. Not connected

3. Ground lead (Black)



DRIVE/REVERSE MODE SELECTOR CONNECTOR



1. Signal (D) for control unit (Light blue)

2. Negative from control unit (Grey-Green)

3. Signal (R) for control unit (Grey-Black)

4. Not connected

5. Not connected

6. Not connected

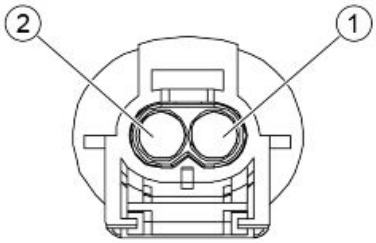
7. Not connected

8. Not connected

9. Not connected

10. Not connected

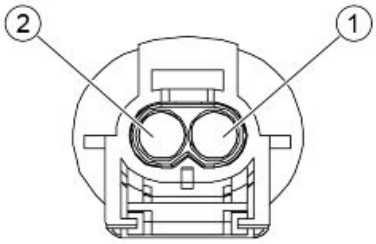
RH FRONT ABS SENSOR CONNECTOR



1. Negative from ABS control unit (Purple-Black)

2. Signal (Purple-Red)

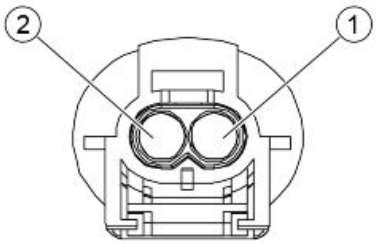
LH FRONT ABS SENSOR CONNECTOR



1. Negative from ABS control unit (Light blue-Black)

2. Signal (Sky blue-Red)

REAR ABS SENSOR CONNECTOR



1. Negative from ABS control unit (Brown-Black)

2. Signal (Brown-Red)

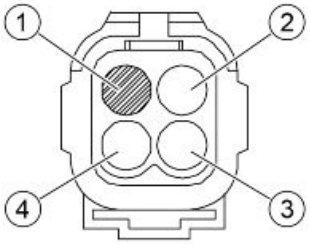
TIPPING SENSOR CONNECTOR

1. Not connected

2. Negative from injector control unit (Grey-Green)

3. Ignition switched live (Brown-Red)

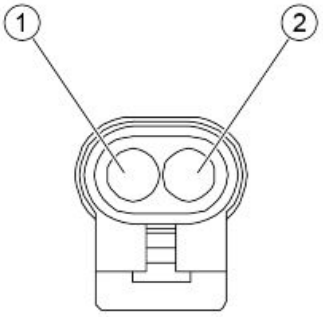
4. Signal (Orange-Green)



BRAKE CALLIPER SENSOR CONNECTOR

1. Ground lead (Black)

2. Parking electronic control unit (Brown)



THROTTLE GRIP POSITION SENSOR CONNECTOR (1)

A. +A SLAVE (Brown-Red)

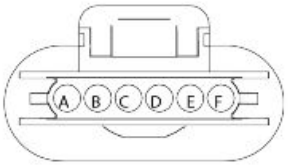
B. -A SLAVE (Brown-Black)

C. A SLAVE signal (Brown-White)

D. Not connected

E. Not connected

F. Not connected



THROTTLE GRIP POSITION SENSOR CONNECTOR (2)

A. +A MASTER (Light blue-Red)

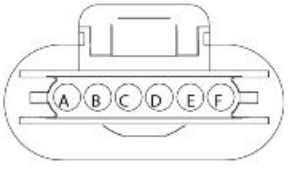
B. -A MASTER (Light blue-Black)

C. A MASTER signal (Light blue-Yellow)

D. +B MASTER (Light blue-Green)

E. -B MASTER (Light blue-Black)

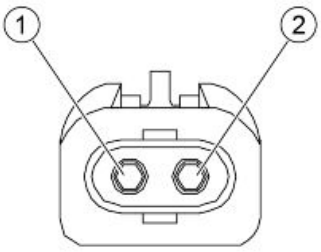
F. B MASTER Signal (Light blue-White)



RIDER PRESENT SENSOR CONNECTOR

1. Rider present sensor (Purple)

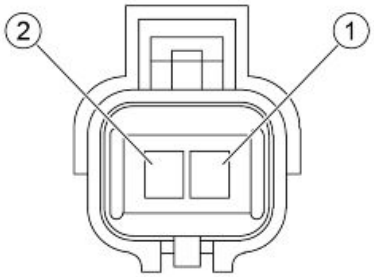
2. Negative from parking electronic control unit (Yellow-Grey)



PRESSURE SENSOR CONNECTOR

1. Horn relay (Yellow-Red)

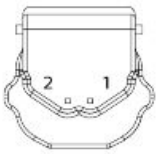
2. Power supply (Blue-Black)



OIL PRESSURE SENSOR CONNECTOR

1. Instrument panel (Red-White)

2. Not connected

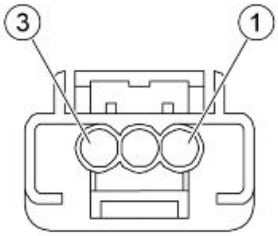


ROTATION SENSOR CONNECTOR

1. Power supply from parking command control unit (Orange-Blue)

2. Signal (Green-Blue)

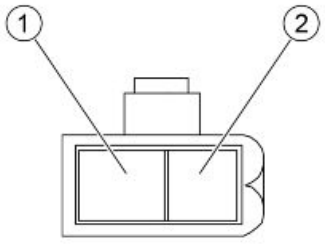
3. Negative from parking electronic control unit (Yellow-Grey)



EXTERNAL TEMPERATURE SENSOR CONNECTOR

1. Ground lead (Black)

2. Signal (Yellow-Blue)



ENGINE TEMPERATURE SENSOR CONNECTOR

1. Signal (Light blue-Green)

2. Instrument panel (Light blue-Black)

3. Negative from control unit (Grey-Brown)

4. Ground lead (Black)

T-MAP SENSOR CONNECTOR

1. Negative from injector control unit (Grey-Green)

2. Temperature signal (Yellow-Blue)

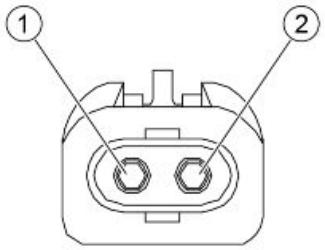
3. Power supply from the injection control unit (Red-Green)

4. Pressure signal (Yellow-Green)

RH SPEED SENSOR CONNECTOR

1. Negative from parking electronic control unit (Yellow-Grey)

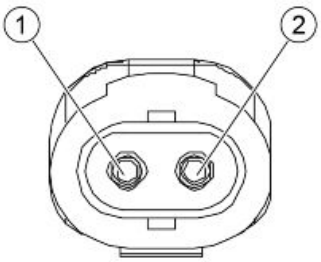
2. Speed sensor (Red)



LH SPEED SENSOR CONNECTOR

1. Negative from parking electronic control unit (Yellow-Grey)

2. Speed sensor (Green)



LAMBDA PROBE CONNECTOR

1. Lambda signal + (Green-Blue)

2. Lambda signal - (Light blue-Black)

3. Power supply heater from injection load relay (Black-Green)

4. Heater negative from injection control unit (White-Blue)

ENGINE STOP RELAY CONNECTOR

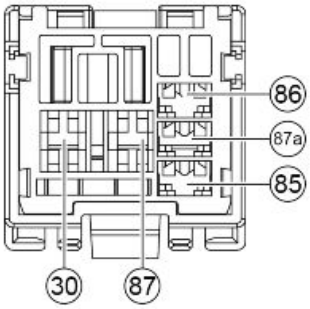
30. Negative from injector control unit (Grey-Green)

87. Not connected

85. Engine stop switch (Orange-Light blue)

86. Live supply (Orange-Blue)

87a. Injection ECU (Yellow-Blue)



SADDLE OPENING ACTUATOR RELAY CONNECTOR

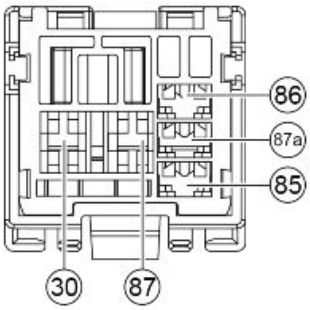
30. Battery-powered (Blue)

87. Saddle opening signal (Yellow-Grey)

85. Ground lead (Black)

86. PMP3 ECU (Blue-Yellow)

87a. Not connected

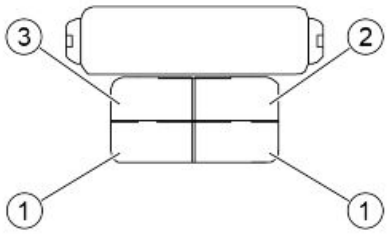


STARTER RELAY CONNECTORS

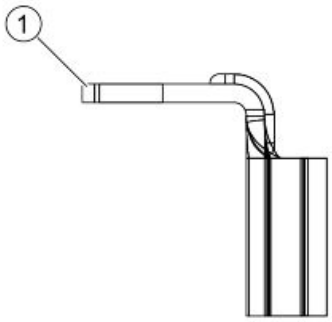
1. Battery-powered (Red-Black)

2. Ignition switched live (Red)

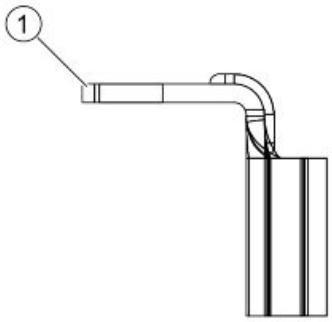
3. Enable from injection control unit (Purple-White)



1. Battery (Red)



1. Starter motor (Red)



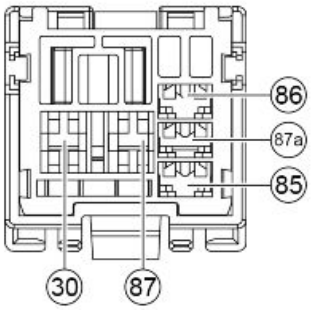
HORN RELAY CONNECTOR

30. Ignition switched live (Yellow-Red)

85. Parking electronic control unit (White)

86. Pressure sensor (Blue-Black)

87. Horn (Yellow-Pink)



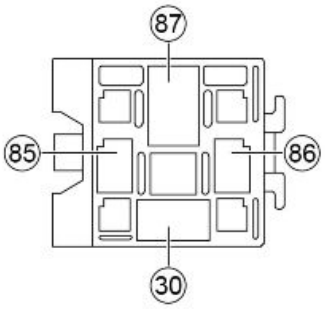
REVERSE GEAR ENABLE RELAY CONNECTOR

30. Battery (Red)

85. Injection ECU (Blue)

86. Power supply from injection relay (Black-Green)

87. Reverse gear motor (via relay) (Red)



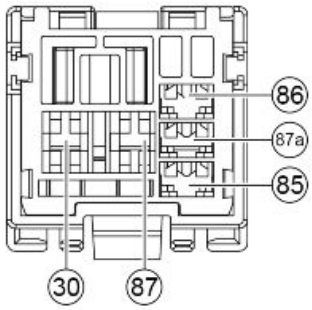
ELECTRIC FAN RELAY CONNECTOR

30. Battery-powered (Grey-Black)

85. Activation from the injection control unit (White)

86. Power supply from injection relay (Black-Green)

87. Electric fan power supply (Red)



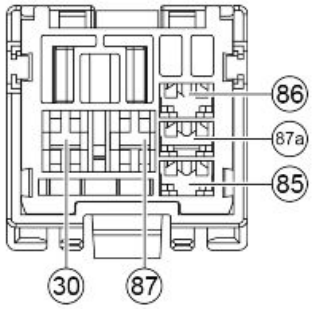
INJECTION RELAY CONNECTOR

30. Battery powered (Red-Green)

85. Activation from injection control unit (Black-Purple)

86. Battery powered (Red-Green)

87. Injection loads power supply (Black-Green)



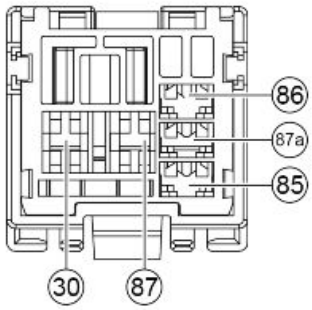
STOP LIGHTS RELAY CONNECTOR

30. Brake lights (White-Black)

85. Ignition switched live (Red)

86. Negative from the injection control unit (Green-White)

87. Ignition switched live (Red)



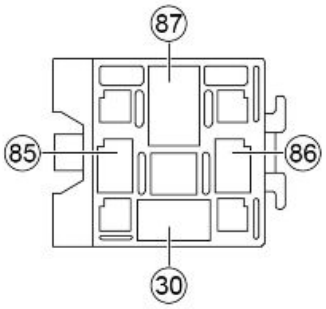
REVERSE GEAR MOTOR RELAY CONNECTOR

30. Reverse gear enable relay (Red)

85. Negative from control unit (White-Purple)

86. Injection load relay (Black-Green)

87. Reverse gear motor (Red)



FUEL PUMP RELAY CONNECTOR

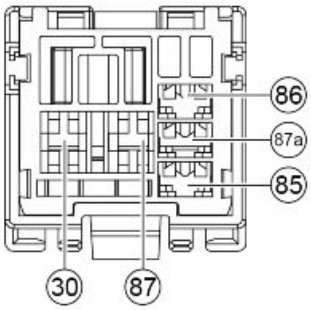
30. Injection load relay (Black-Green)

87. Fuel pump (Green)

85. Activation from injection control unit (Purple-Black)

86. Ground lead (Black)

87a. Not connected



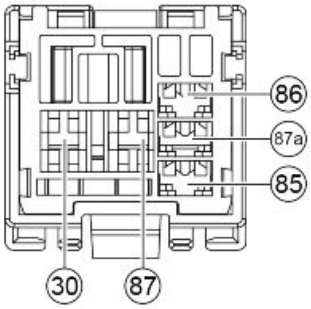
HEADLIGHT RELAY CONNECTOR

30. Battery-powered (Blue)

85. Parking electronic control unit (White-Black)

86. Ignition switched live (Yellow-Black)

87. Column light switch (Yellow-Red)



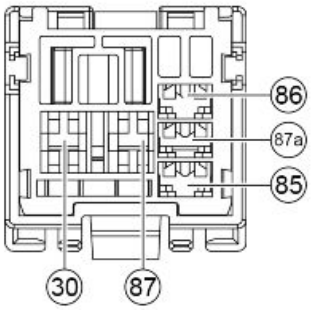
SOLENOID RELAY CONNECTOR

30. Power supply from injection relay (Black-Green)

85. Injection ECU (Light blue-Red)

86. Starter button (Purple)

87. Reverse gear motor relay and actuator unit (Green)

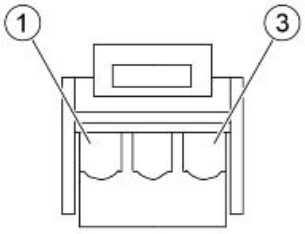


FUEL LEVEL TRANSMITTER CONNECTOR

1. Not connected

2. Ground lead (Black)

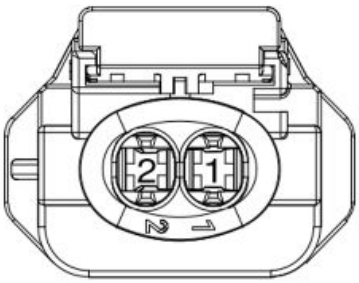
3. Signal (White-Green)



CANISTER VALVE CONNECTOR

1. Injection load relay (Black-Green)

2. Negative from injection control unit (White-Black)



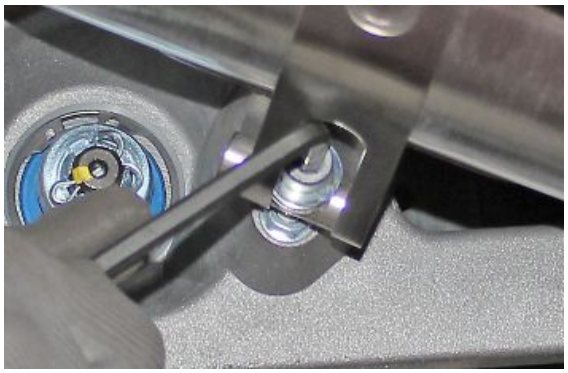
INDEX OF TOPICS

Exhaust assy. Removal

- First remove the heat shield by unscrewing the two indicated screws.

- Remove the chassis central cover.
- Loosen the fixing clamp between the manifold and the exhaust end.

- Loosen the rear lock nut fixing the silencer to the bracket.



- Remove the rear screw fixing the silencer to the bracket.
- Slide off the mounting plate of the exhaust end from the upper housing.

- Remove the front screw fixing the exhaust end to the bracket.

- Remove the exhaust en by sliding it off the manifold.

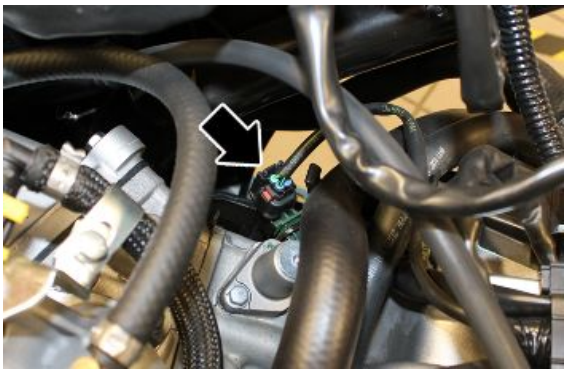
CAUTION

SHOULD IT BE NECESSARY TO REMOVE ONLY THE SILENCER TIP, ALWAYS REPLACE THE GRAPHITE GASKET BETWEEN STUB AND TIP.

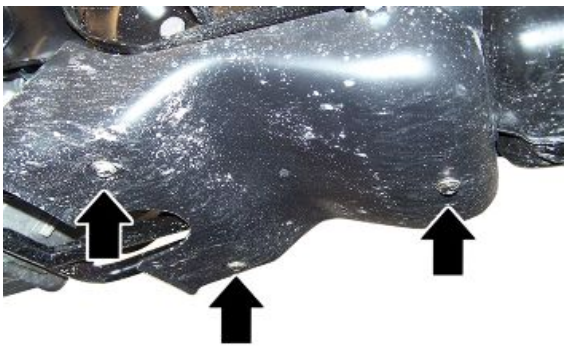
- Release the lambda probe connector and disconnect it.

CAUTION

FREE THE CABLES OF THE LAMBDA PROBE BEFORE REMOVING THE SILENCER, PUTTING THIS CABLE HARNESS UNDER AN EXCESSIVE VOLTAGE MAY DAMAGE IT.

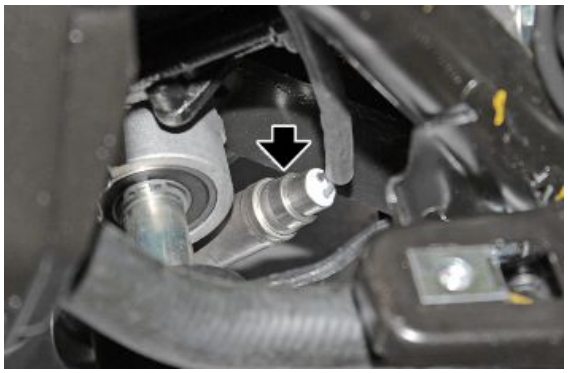


- Remove the lower cover placed under the exhaust manifold by unscrewing the three indicated clamps and collecting the washers and spacers.



- Remove the two exhaust manifold fixings at the engine head.

- Remove the exhaust manifold paying attention to slide off the wiring harness of the lambda probe.



FITTING THE COMPLETE SILENCER

CAUTION

WARNING

ALWAYS REPLACE THE GRAPHITE GASKET BETWEEN THE PRIMARY PIPE AND SILENCER.

- If necessary, install the lambda probe on the exhaust manifold.

Locking torques (N*m)

Lambda probe tightening on exhaust manifold **40 - 50**

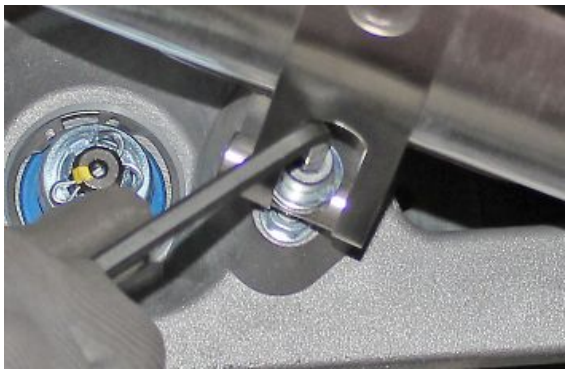
- Insert the nuts used to fasten the exhaust manifold to the big end. To insert the nuts that fix the silencer flange to the big end properly, use a jointed wrench that allows, according to the travel direction, to get also at the right nut. That is difficult to do with a traditional straight wrench.

Locking torques (N*m)

Manifold/silencer joint tightening torque **12 - 13**

- Insert the exhaust end in the silencer, position the support band on the specific top slit of the silencer support plate, then block it with the relative bushing.

- Insert the screw in the bottom slit, screwing in the counter nut from the opposite side.



- Insert the front fixing screw and lock it at the recommended torque.

Locking torques (N*m)

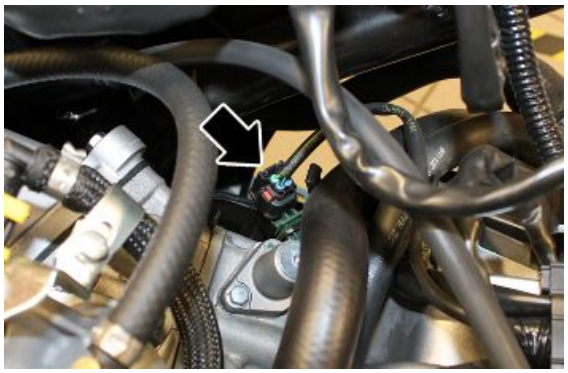
Screw used to fasten silencer to supporting arm **20 - 25**

- Lock the fixing clamp between the manifold and the terminal.

Locking torques (N*m)

Manifold - silencer diaphragm tightening clamp **16 - 18**

- Connect the lambda probe connector and fasten it to the respective support.



- Fit the heat shield and tighten the two screws, tightening to the prescribed torque.

Locking torques (N*m)

Silencer heat guard fixing screw **4 - 5 Nm (3 -3.7 lb*ft)**

Removal of the engine from the vehicle

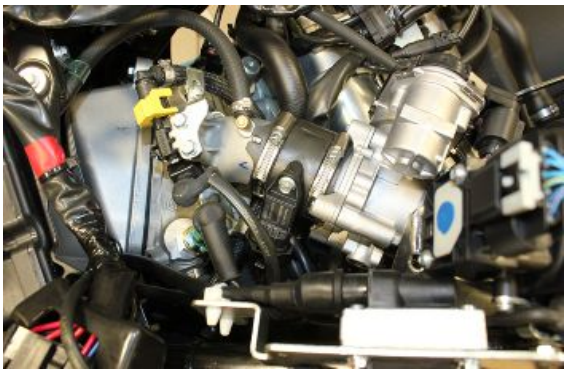
- Use a jack to support the vehicle properly.
- Disconnect the battery.
- Remove the helmet compartment.
- Remove the side fairings.
- Remove the footrests.
- Remove the complete silencer.

CAUTION

THIS OPERATION MUST BE CARRIED OUT WHEN THE ENGINE IS COLD.

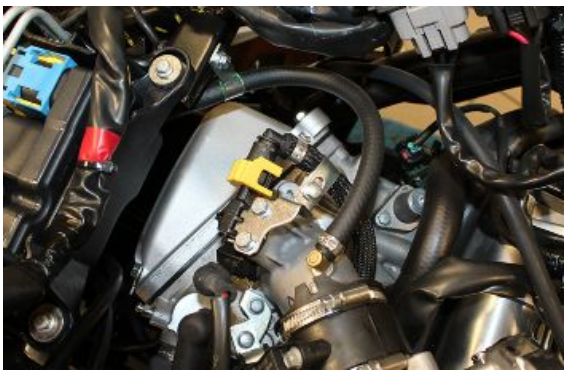
- Disconnect the connectors of the injector and of the engine temperature sensor.

- Disconnect the T-MAP sensor connector.



- Disconnect the throttle body connector.

- Remove the corresponding stop and disconnect the fuel piping.
- Unscrew the bolt fixing the fuel piping to the engine head.

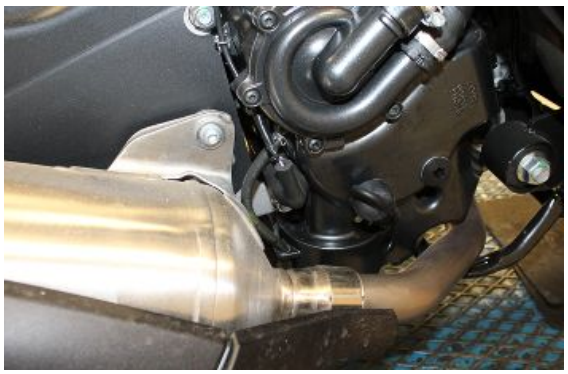


- Open the clamp to release the main wiring harness.
- Disconnect the rear ABS sensor connector, then remove the clamp from the bracket and release the connector.

- Disconnect the starter motor positive wire.

- Disconnect the starter motor negative cable and the engine ground cable.

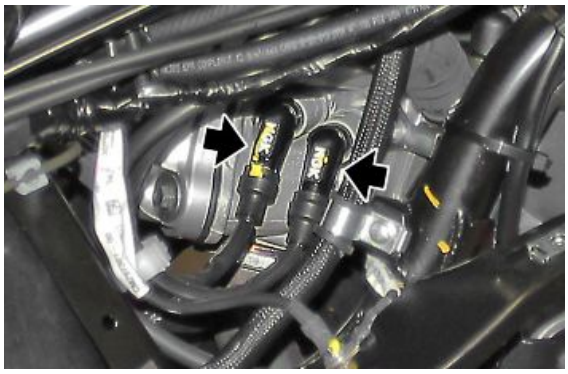
- Disconnect the oil pressure sensor and release the cable.



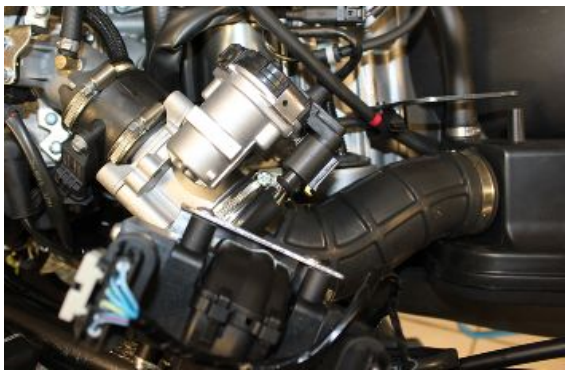
- Disconnect the voltage regulator connectors and release the flywheel side wiring harness.

- Disconnect the engine rpm sensor connector and release it from the slide housing.

- Disconnect the spark plug caps.



- Remove the clamp and disconnect the filter box sleeve.

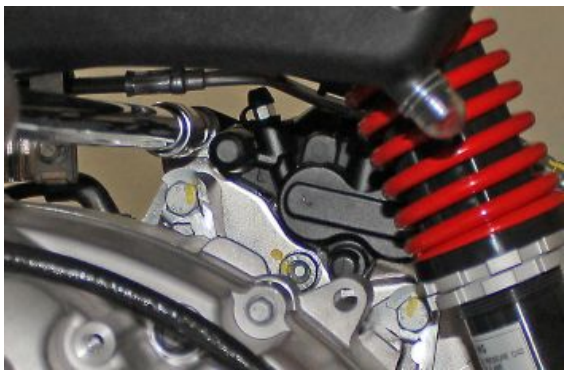


- Undo the two screws fixing the filter box to the crankcase.

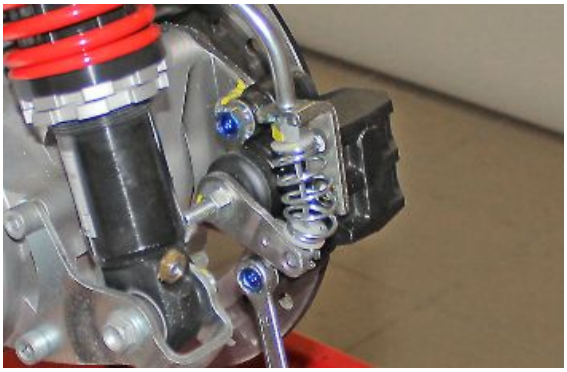
Unscrew the four screws and remove the transmission protection cover.

- Undo the screw fixing the filter box to the internal bracket and disconnect the oil drainage recovery pipe, then remove the filter box.
- Remove the rear wheel as described in chapter "Suspensions".

- Remove the rear brake calliper.



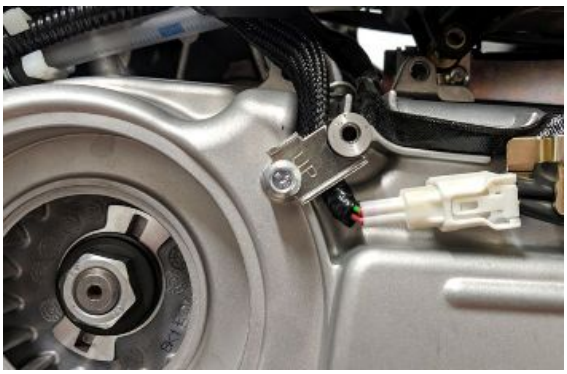
- Remove the parking brake calliper.



- Open the clamp and unscrew the fixing bolt to release the brake pipes.

Open the contact box of the reverse gear motor, unscrew the nuts of the plate, remove it and disconnect the cable.

Unscrew the screw of the wiring harness retaining plate and remove it.



Unscrew the screw and remove the second plate.

Remove the fasteners of the reverse gear actuator unit (3 screws).

Disconnect the connector and remove the unit.

CAUTION

WARNING

TO RELEASE THE FASTENING PIN OF THE CONNECTOR, PRESS AS SHOWN IN THE IMAGE.

Remove the reverse gear system wiring harness from the right side of the vehicle, pulling the rubber pads out of their seats.

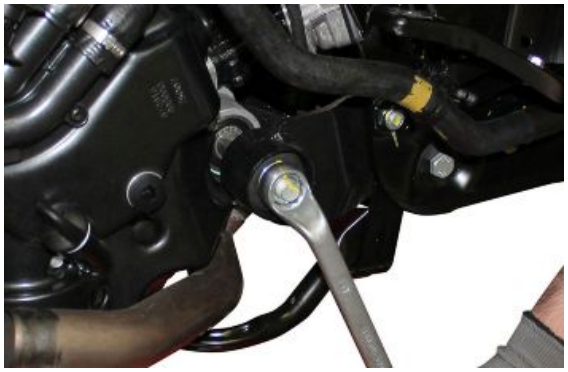
- Unscrew the expansion tank cover, then open the clamp to release the water pump inlet pipe.

- Disconnect the water pump inlet pipe, by removing the clamp, then empty the cooling system.

- Remove the clamp from the coolant outlet pipe from the engine and empty the system from residual fluid.

- Remove the rear left shock absorber lower retainer.

- Remove the swinging arm - engine fixing pin by first undoing the nut and then operating on the head of the pin.
- The engine is now free.

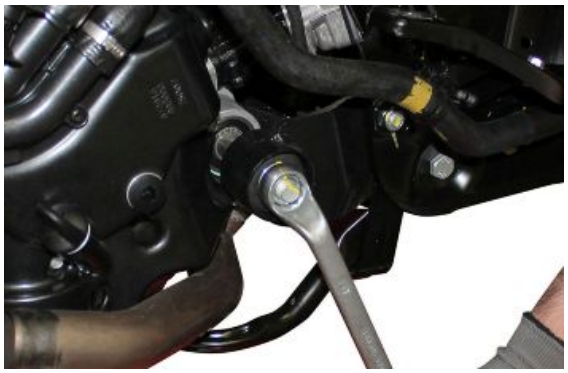


Installing engine in vehicle

- Ensure that the engine is adequately supported, then position it on the vehicle.
- Insert the engine/swing arm fastening pin from the left hand side, then screw the nut on from the silencer side, and apply the pre-defined tightening torque.

Locking torques (N*m)

Engine-swinging arm bolt **98 - 118 Nm (72 -87 lb*ft)**



- Fit the rear, LH shock-absorber, as described in the «Suspensions» section.
- Insert the fastening used to secure the engine to the shock-absorber, and apply the pre-defined tightening torque.

Locking torques (N*m)

Lower shock absorber clamp **40 - 45 Nm**

- Connect the engine coolant outlet pipe and secure it with a clamp.

- Connect the engine coolant inlet pipe to the pump and secure it with a clamp.

- Position and secure the water pump inlet pipe in the dedicated cable gland.

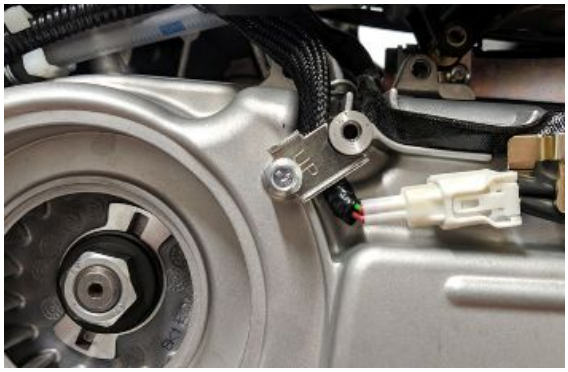
Insert the wiring harness of the reverse gear system from the right side of the vehicle, passing it through the slots as shown in the figure and place the rubber pads in their seats.

Connect the connector of the reverse gear actuator unit.

Fit the reverse gear actuator unit on the crankcase and fasten it (3 screws).

Place the wiring as shown in the figure and screw the upper plate.

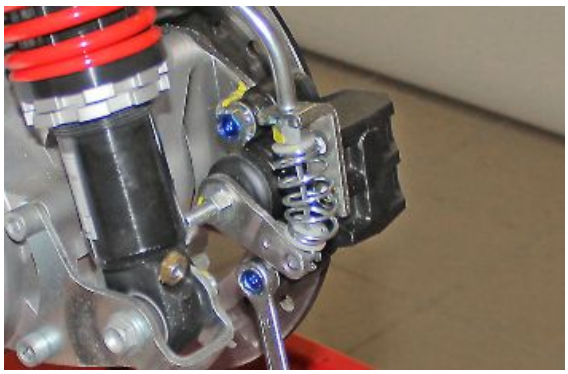
Screw the lower plate, observing the fitting reference on the plate.



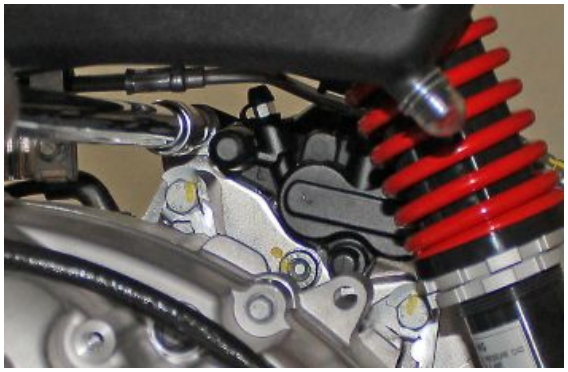
Connect the positive cable of the reverse gear motor, place the plate and screw the nuts.

- Tighten the bolt used to fasten the brake pipes to the engine, as shown in the photo.
- Position and secure the pipes in the dedicated cable gland.

- Fit the parking brake calliper.



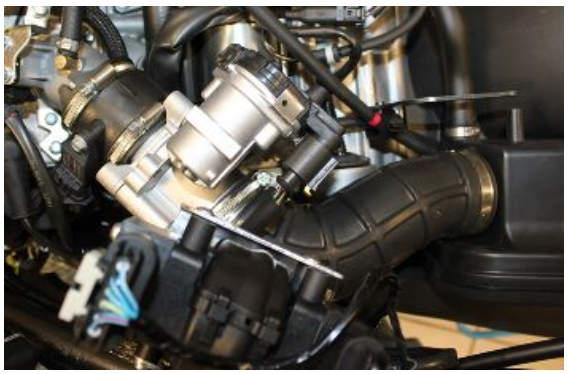
- Fit the rear brake calliper.



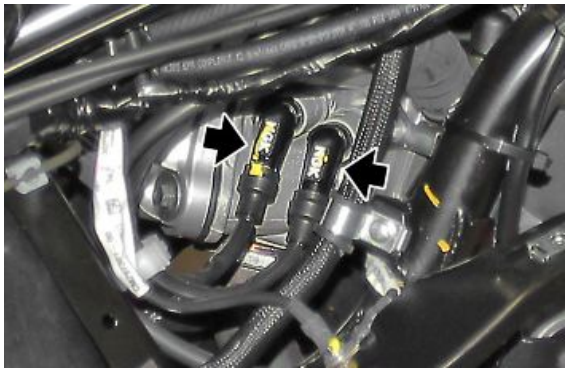
- Fit the rear wheel as described in the «Suspensions» section.
- Insert the screw used to fasten the filter box to the respective bracket, as shown in the photo.

- Insert the two screws used to fasten the air filter box to the crankcase.

- Connect the filter box sleeve, then secure it by screwing the clamp into place.



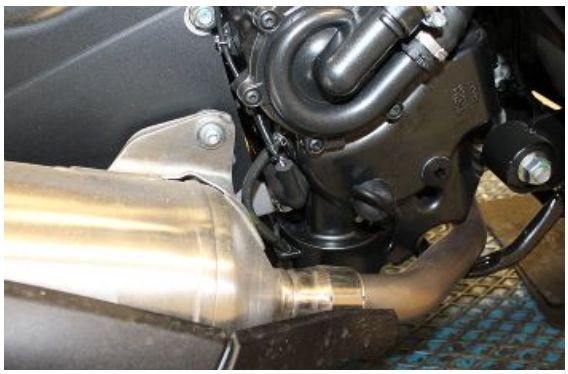
- Connect the two spark plug hoods.



- Connect the engine speed sensor and fasten it to the chassis using the respective "slide" fitting.

- Connect the connectors of the voltage regulator.

- Connect the oil pressure sensor and position the cable in its housing, as shown in the photo.

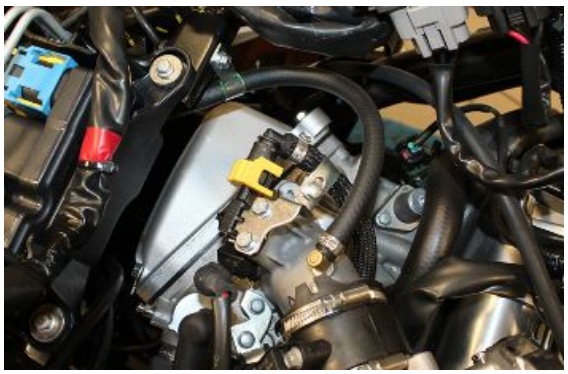


- Fasten the starter motor negative cable.

- Fasten the starter motor positive cable.

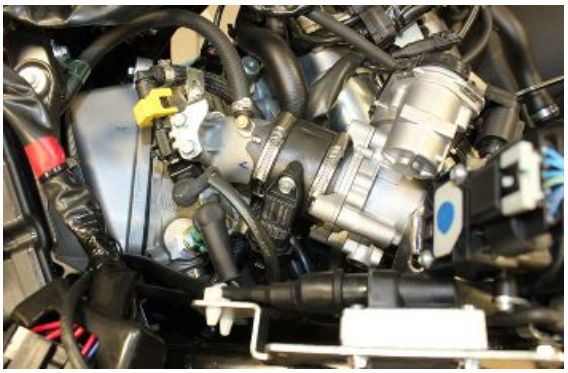
- Fasten the main cable harness with the special clamp.
- Connect the rear ABS sensor connector and fasten it in the appropriate "slide" fitting.

- Screw the fuel pipe fastening to the cylinder head.
- Connect the fuel pipe to the injector and fasten the pipe as shown in the figure.



- Connect the throttle body connector.

- Connect the T-MAP sensor connector.



- Connect the injector and temperature sensor connectors.

- Check the engine oil level and if necessary, top it up using the recommended type.
- Fill and bleed the cooling circuit.
- Check accelerator and electric devices for correct functioning.

Recommended products

Engine oil 5W -40 Synthetic-based lubricant for four-stroke engines.

SAE 5W-40; JASO MA, MA2; API SL; ACEA A3

Anti-freeze liquid, ready to use, colour red Ethylene glycol antifreeze liquid with organic inhibition additives. Red, ready to use.

ASTM D 3306 - ASTM D 4656 - ASTM D 4985 - CUNA NC 956-16

INDEX OF TOPICS

ENGINE	ENG

This section describes the operations to be carried out on the engine and the tools to be used.

Automatic transmission

Transmission cover

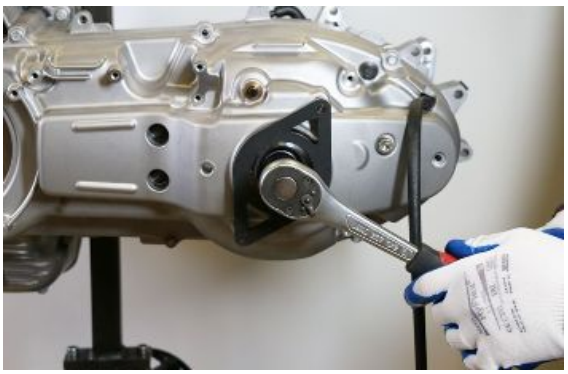
- Loosen the 4 fastening screws
- Extract the outside plastic transmission cover.

- Use a screwdriver to remove the driven pulley axle cover.

- Install the specific tool in the appropriate slots and unscrew the driven pulley axle nut.
- Remove the nut and the two washers.
- Remove the special tool.

Specific tooling

021022Y Driven pulley stop



- Remove the transmission cover screws

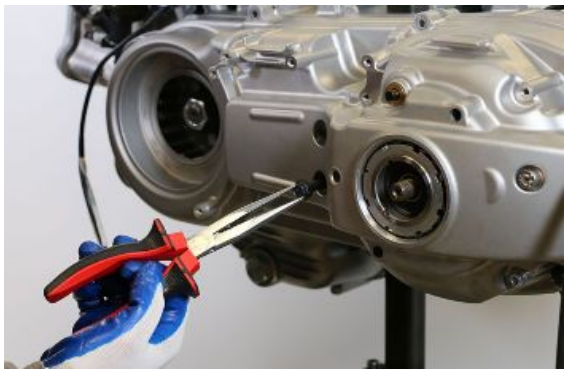
7 M6 screws

- Remove the screws from the right side of the cover

2 M8x70 screws

- Remove the screws from the central part.

2 M8x100 screws



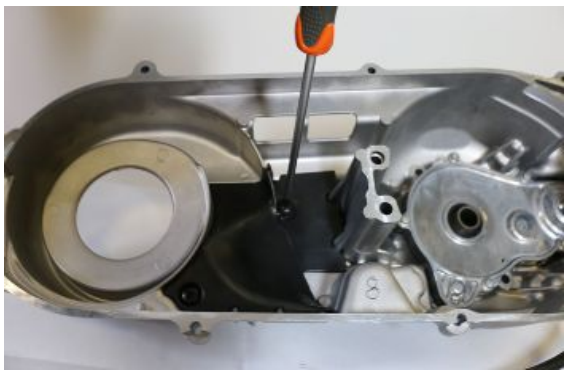
- Remove the transmission cover.
- Check that the bearing rotates freely, otherwise replace the bearing.

Air duct

- Remove the transmission cover.
- Unscrew the two screws shown in the figure to remove the air conveyor.

Locking torques (N*m)

Air conveyor screws **11 - 12**



Removing the driven pulley shaft bearing

- Remove the transmission cover.
- Remove the Seeger ring.

- Place transmission cover on a wood surface and use the special tool so that it is adequately supported.
- Pull out the bearing using the special tool.

N.B.

BELL MUST BE PLACED INTO THE TRANSMISSION COVER, CLOSE TO THE BEARING SEAT AND THE WOODEN SURFACE, SINCE WITHOUT BELL THE ENTIRE COVER STRUCTURE WOULD BEND. NOT ONLY IN THE AREA OF MAXIMUM STURDINESS.

Specific tooling

001467Y002 Driver for OD 73 mm bearing

020376Y Adaptor handle

020375Y 28 x 30 mm adaptor

020439Y 17-mm guide

Refitting the driven pulley shaft bearing

- Heat the transmission cover interior using the heat gun.

N.B.

BE CAREFUL NOT TO OVERHEAT THE COVER AS THIS WOULD DAMAGE THE OUTSIDE PAINTED SURFACE.

Specific tooling

020151Y Air heater

- Place the bearing onto the special tool with a little grease to prevent it from coming out.
- Install the new bearing using the special tool.

N.B.

PROPERLY SUPPORT THE OUTSIDE COVER TO PREVENT DAMAGING THE PAINTED SURFACE.

Specific tooling

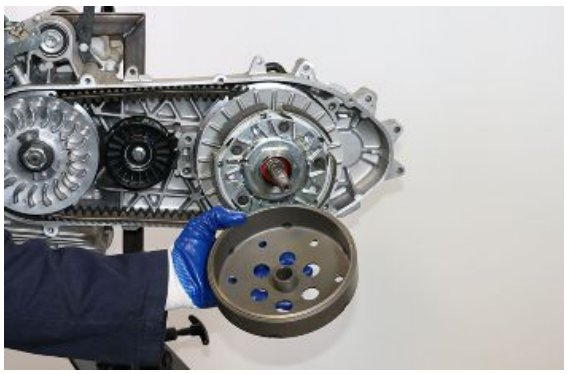
020376Y Adaptor handle

020358Y 37 x 40 mm Adaptor

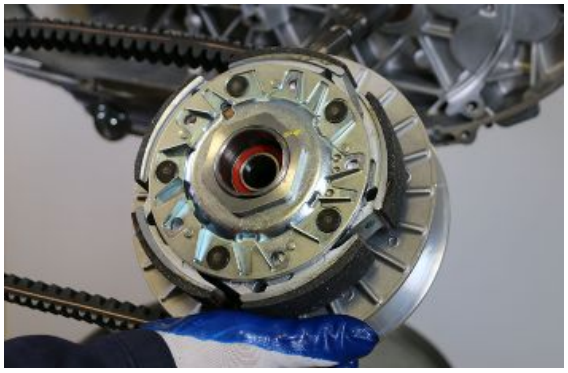
020439Y 17-mm guide

Removing the driven pulley

- Remove the housing clutch, if necessary levering with a screwdriver and using a plastic mallet.



- Remove the stationary driving half-pulley.
- Remove the driven pulley assembly with the belt.



Baffle roller

Plastic roller

- Check that the roller does not show signs of wear and that it turns freely.
- Loosen the retaining bolt using a 13 mm spanner.
- Remove the complete roller with bearing.

N.B.

IF THE ROLLER DOES NOT ROTATE FREELY, REPLACE THE COMPLETE ROLLER.

Installation of belt anti-vibration roller

- Install the anti-flapping roller with the lip facing the engine crankcase.
- Tighten the central screw to the prescribed torque.

N.B.

TURN THE DRIVEN AND/OR DRIVING PULLEY UNTIL A CORRECT TENSIONING OF THE BELT IS OBTAINED.

Locking torques (N*m)

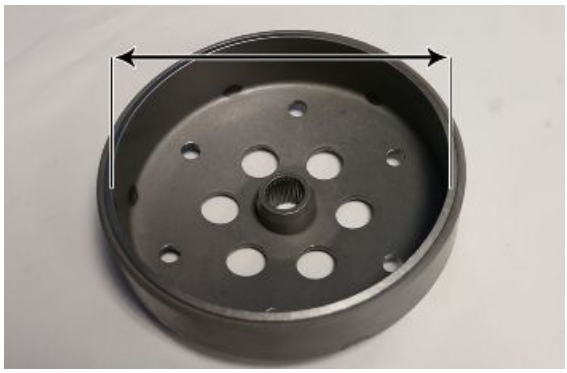
Anti-vibration roller screw **16.7 ÷ 19.6**

Inspecting the clutch drum

- Check that the clutch bell is not worn or damaged.
- Measure the clutch bell inside diameter.

N.B.

CHECK THE ECCENTRICITY MEASURED, 0.2 MM MAX.



Characteristic

Max. value:

160.5 mm

Standard value:

160.2 mm

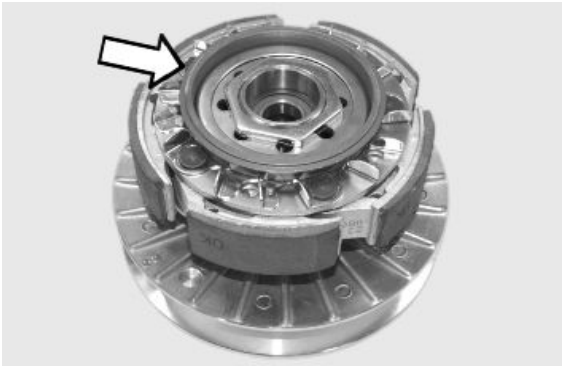
Removing the clutch

- To remove the clutch with the driven pulley it is necessary to use the special tool.
- Arrange the tool with the mean pins screwed in position "**E**" on the inside.

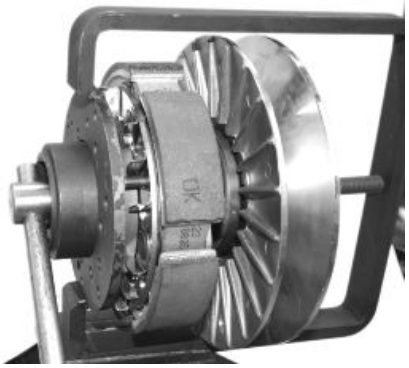
Specific tooling

020444Y Tool for installing/removing clutch on/from driven pulley

- Fit the adapter ring to the clutch assembly as shown in the photograph.



- Install the driven pulley unit onto the tool inserting the pins into the ventilation holes.
- Move the rear stop screw in abutment against the fixed driven pulley as shown in the figure.



CAUTION

THE TOOL SHOULD BE FIRMLY SECURED IN A VICE USING THE SPECIAL TOOL. DO NOT TIGHTEN THE REAR SCREW TOO MUCH AS THIS COULD IRRETRIEVABLY DEFORM THE TOOL.
USING THE SPECIAL 55-MM WRENCH, REMOVE THE FASTENING RING NUT.
LOOSEN THE TOOL SCREW AND DISASSEMBLE THE DRIVEN PULLEY UNIT, CLUTCH, SPRING WITH SHEATH.

Inspecting the clutch

- Check the thickness of the clutch mass friction material.

Characteristic

Minimum thickness permitted:

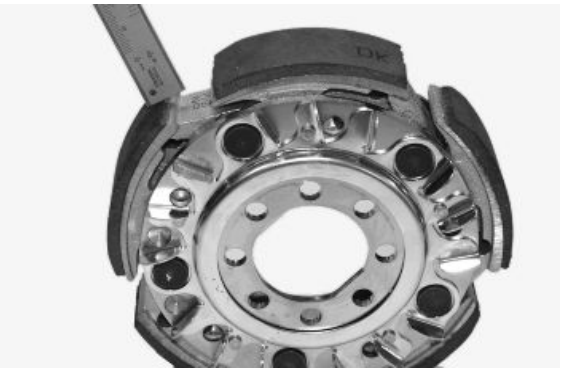
1 mm

- The masses must not show traces of lubricants. Otherwise, check the driven pulley unit seals.

N.B.

UPON RUNNING-IN, THE MASSES MUST EXHIBIT A CENTRAL CONTACT SURFACE AND MUST NOT BE DIFFERENT FROM ONE ANOTHER. VARIOUS CONDITIONS CAN CAUSE THE CLUTCH TO TEAR.

- Do not open the masses using tools to prevent a variation in the return spring load.



Pin retaining collar

- Extract the collar using 2 screwdrivers.

- Remove the 4 guide pins.
- Extract the moving driven half-pulley.

Inspecting the driven fixed half-pulley

- Check that the belt contact surface is free from wear.
- Measure the outer diameter of the pulley bushing.

Characteristic

Minimum admissible diameter

49.91 mm

Standard diameter:

50.00 -0.015 -0.035 mm

Removing the driven half-pulley bearing

- Check that the bushing is free from wear and damage; otherwise replace the fixed driven half-pulley.
- Remove the lock ring using pliers.

- Using the special tool inserted through the roller bearing, pull out the ball bearing.

N.B.

PROPERLY SUPPORT THE PULLEY TO PREVENT DAMAGING THE THREADING.

Specific tooling

020376Y Adaptor handle

020456Y Ø 24 mm adaptor

020363Y 20-mm guide

N.B.

IF YOU NEED TO OVERHAUL THE BEARINGS ON AN ASSEMBLED DRIVEN PULLEY UNIT, IT IS NECESSARY TO SUPPORT THE UNIT BY THE BELL

Specific tooling

001467Y002 Driver for OD 73 mm bearing

- Remove the roller bearing using the special tool, supporting the fixed half-pulley with the bell.

Specific tooling

020376Y Adaptor handle

020375Y 28 x 30 mm adaptor

020364Y 25-mm guide

001467Y002 Driver for OD 73 mm bearing

Inspecting the driven sliding half-pulley

- Check that the belt contact surface is free from wear.
- Remove the 2 inside sealing rings and the 2 outside O-rings.
- Measure the movable half-pulley bushing inside diameter.

Characteristic

Maximum admissible diameter:

50.05 mm

Standard diameter:

50.00 +0.035 0.00 mm

Refitting the driven half-pulley bearing

- Install a new roller bearing using the special tool.

N.B.

PLACE THE BEARING WITH THE WRITINGS AND THE EMBEDDED OIL GUARD FACING OUTWARDS.

- Properly support the half-pulley to prevent damaging the threading.

If you are working on the driven pulley unit fully assembled, use the special tool.

Specific tooling

020478Y Punch for roller casing

001467Y002 Driver for OD 73 mm bearing

- Install a new ball bearing using the special tool.

Specific tooling

020376Y Adaptor handle

020477Y Adapter 37 mm

020363Y 20-mm guide

- Insert the Seeger lock ring.

Refitting the driven pulley

- Insert the new oil guards
- Insert the new O-rings

N.B.

O-RINGS ARE OF TWO SIZES. THE LARGE ONE IS INSTALLED ON THE MACHINING END RADIUS, AT THE BASE OF THE HALF-PULLEY.

- Install the half-pulley on the bushing being careful not to damage the top sealing ring during the introduction.
- Make sure the pins and collar are not worn, reassemble the pins and collar.

- Using a bent beak greaser, lubricate the driven pulley unit with about 10 gr. of grease, this operation should be carried out through one of the two holes into the bushing to obtain the exit of the grease from the opposite hole. This operation is necessary to avoid the presence of grease beyond the O-rings.

Recommended products

Molybdenum disulphide grease Lithium grease with molybdenum disulphide

Grey black grease.

Inspecting the clutch spring

Measure the free length of the return spring between the clutch and the driven half-pulley.

Characteristic

Standard length:

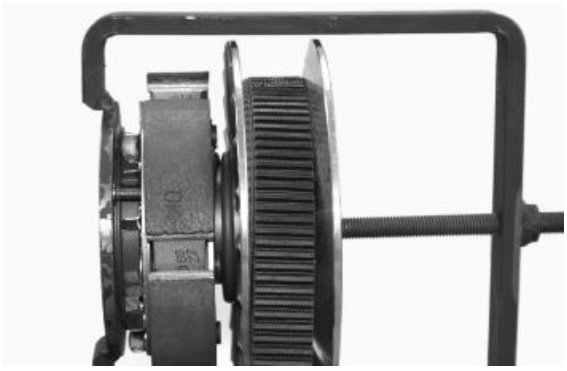
146,5 mm

Limit length allowed after use:

137,0 mm

Refitting the clutch

- Prepare the special tool as for removal;
- Preassemble the driven pulley unit with the drive belt according to its direction of rotation;
- Insert the driven pulley unit, the spring with sheath and clutch into the tool.



Specific tooling

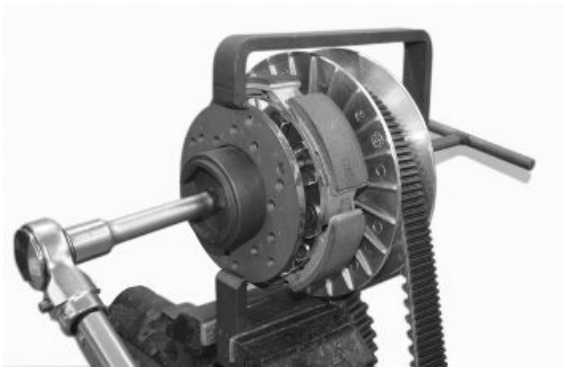
020444Y Tool for installing/removing clutch on/from driven pulley

- Compress the spring and insert the clutch on the driven pulley bushing.

N.B.

BE CAREFUL NOT TO DAMAGE THE SHEATH OR THE BUSHING THREADED END.

- Tighten the ring nut by hand and complete the tightening using the special wrench to the prescribed torque.



Specific tooling

020444Y Tool for installing/removing clutch on/from driven pulley

Locking torques (N*m)

Clutch ring nut **65 - 75**

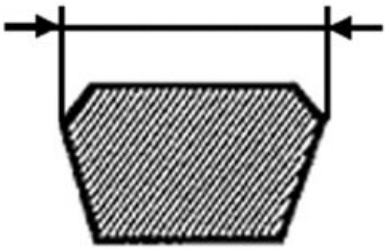
- To facilitate reassembly on the engine, turn the moving driven pulley and insert the belt onto the smaller diameter.

Refitting the driven pulley

- Install the driven pulley assembly with belt.

Drive-belt

- Check that the driving belt is not damaged.
- Check the width of the belt.



Characteristic

Minimum width

27.5 mm

Overall width

28.7 mm

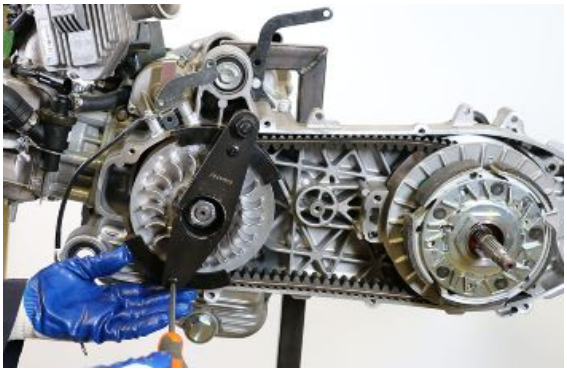
Removing the driving pulley

- Fit the specific tool, first inserting the two retainer clamps onto the pulley so that the splines are completely engaged.

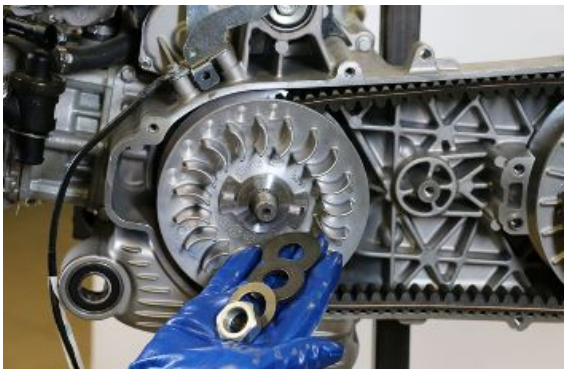
Specific tooling

020474Y Driving pulley immobiliser tool

- Screw, also manually, the 2 fixing screws on the main tool.



- Using a 27 mm wrench, unscrew the central nut of the pulley drive.
- Remove the washers.
- Remove the stationary driving half-pulley.



- Remove the driven pulley assembly with the belt.

- Remove the bushing connection washer.

- Remove the mobile driving half-pulley with the relevant bushing, being careful not to let the rollers to come out.

- Remove the rear washer.

- The transmission side casing is now free.

Inspecting the rollers case

- Check that the inside bushings shown in the figure exhibit no signs of abnormal wear and measure the inside diameter.

CAUTION

DO NOT LUBRICATE OR CLEAN THE BUSHINGS

Characteristic

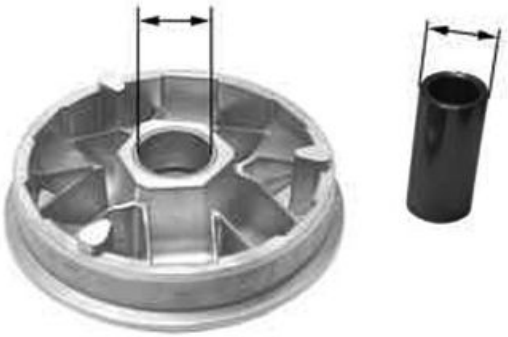
Maximum admissible diameter:

30.12 mm

Standard diameter:

30.021 mm

- Measure the pulley sliding bushing outside diameter shown in the figure.



Characteristic

Minimum admissible diameter

Ø 29.95 mm

Standard diameter:

Ø 29.959 mm

- Check that the rollers are not damaged or worn.

Characteristic

Minimum admissible diameter

Ø 24.5 mm

Standard diameter:

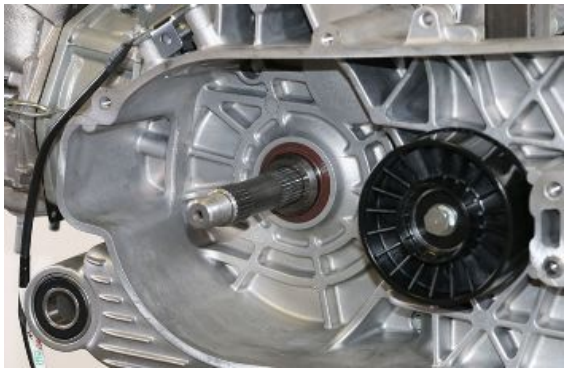
Ø 24.9 mm

- Check the guide shoes for the variator back-plate are not worn.
- Check the wear of the roller housings and of the belt faying surfaces on both pulley halves.

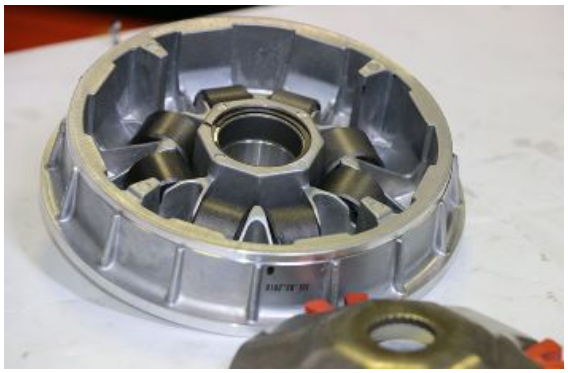
Refitting the driving pulley

Installing the roller container

- Install the spacer with the internal chamfer facing towards the inside.



- Check the sliding shoes for the variator back-plate are not worn.
- Check the wear of the roller housings and of the belt facing surfaces on both pulley halves.
- Position the rollers on the half-pulley as shown in the figure.
- The closed side must rest on the inside thrust face of the roller container.



- Assembly the half-pulley with the roller contrast plate and sliding shoes.

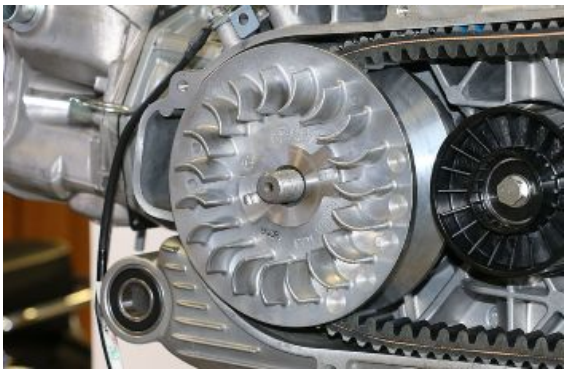
- Insert the bushing and driving half-pulley .

- Fit the transmission belt on the driven pulley.

Installing the fixed driving half-pulley

- Insert the spacer.

- Install the fixed driving half-pulley and check that it is in contact with the spacer and with the guide bushing of the movable driving pulley.



- Remove the flat washer and the spring washer as shown in the figure.

- Insert the nut in the original position (nut side in contact with the belleville washer).

- Fit the specific tool, first inserting the two retainer clamps onto the pulley so that the splines are completely engaged.
- Screw, also manually, the 2 fixing screws on the main tool.

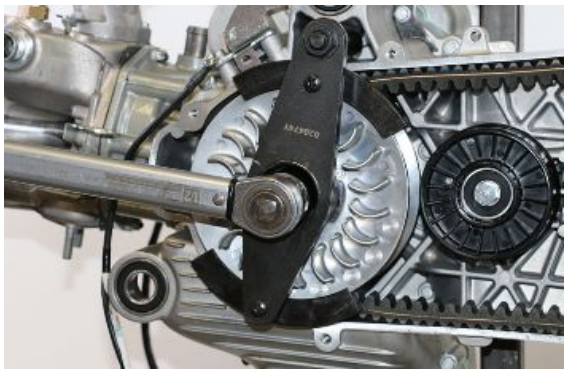
Specific tooling

020474Y Driving pulley immobiliser tool

- Using a 27 mm wrench, fasten the driving pulley fastening nut to the prescribed torque
- Remove the special tool.

Locking torques (N*m)

Driver pulley nut **160 - 175**



Refitting the transmission cover

- Put the transmission cover.

CAUTION

WARNING

THE FOUR M8 SCREWS OF THE TRANSMISSION COVER HAVE DIFFERENT LENGTHS: THE TWO LONG SCREWS MUST BE FITTED ON THE CENTRAL PART, THE TWO SHORT SCREWS ON THE RIGHT SIDE.

- Tighten the screws on the central part.

2 M8x100 screws

Locking torques (N*m)

M8 transmission cover fastenings 23 - 26 Nm (17 -19 lb*ft)

- Tighten the screws on the right part.

2 M8x70 screws

Locking torques (N*m)

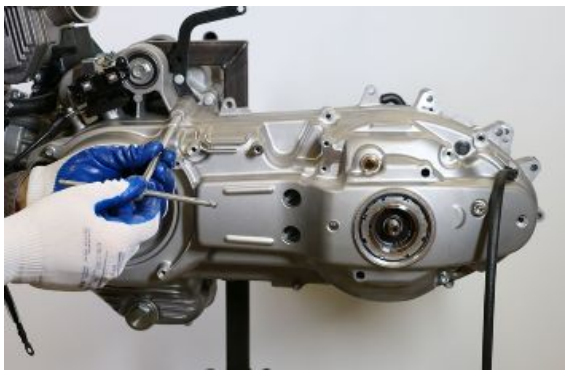
M8 transmission cover fastenings 23 - 26 Nm (17 -19 lb*ft)

- Tighten the transmission cover screws

7 M6 screws

Locking torques (N*m)

M6 transmission cover fastenings 11 - 13 Nm (8 -10 lb*ft)



- Insert the washers on the driven pulley shaft.

N.B.

INSERT THE SMALLER WASHER FIRST, THEN THE LARGER ONE.

- Insert the specific tool in the appropriate slots, if necessary rotate the shaft to engage it fully.

Specific tooling

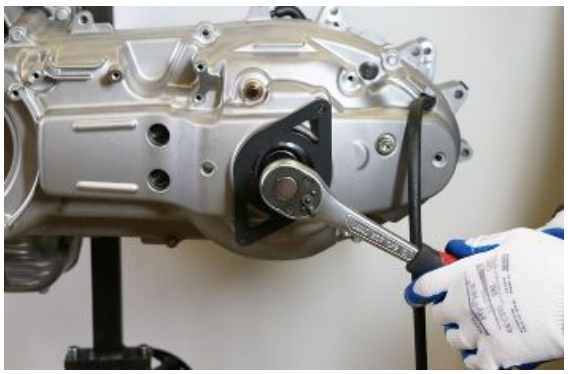
021022Y Driven pulley stop

- Fit the driven pulley axle nut.

- Tighten the nut to the prescribed torque.

Locking torques (N*m)

Driven pulley nut **92 - 100 Nm (68 -74 lb*ft)**



- Remove the special tool.

- Fit the driven pulley axle plug.

N.B.

ENSURE THAT THE AIR INTAKE AND EXHAUST OPENINGS ARE COMPLETELY FREE.

- Install the outside plastic transmission cover.
- Tighten the 4 fastening screws to the prescribed torque.

Locking torques (N*m)

External transmission cover screws **7 - 9**

End gear

Removing the hub cover

- Drain the rear hub oil via the drain screw at the bottom of the engine.

- Remove the fixing screws of the hub cover.

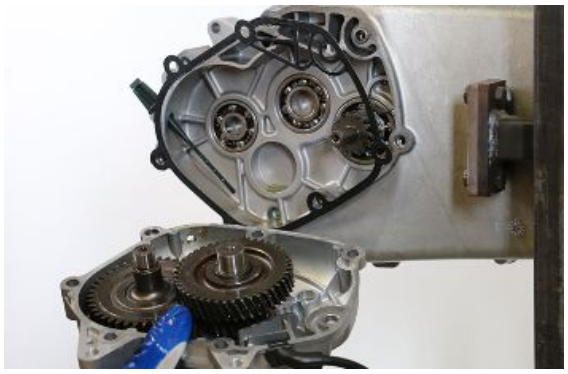
4 long screws

3 short screws

N.B.

THE FIXING SCREWS ARE OF DIFFERENT LENGTHS, TAKE NOTE OF THEIR RESPECTIVE POSITIONS.

- Remove the hub cover and the relative gasket.



Removing the wheel axle

- Remove the countershaft.
- Remove the wheel axis complete with gear.

Removing the hub bearings

- Check all bearings (wear, clearance and noise).

In case of anomalies, proceed as follows.

To remove the gear shaft bearing on the engine crankcase, use the following parts.

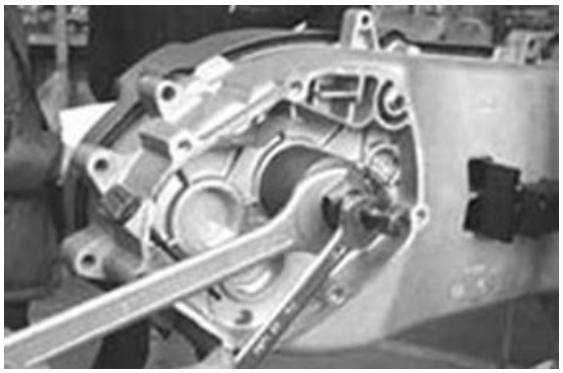
Specific tooling

001467Y014 Calliper to extract ø 15-mm bearings

001467Y034 Calliper to extract ø 15-mm bearings

001467Y031 Bell

- Use the special extractor to disassemble the bearing on the engine chassis of the countershaft.

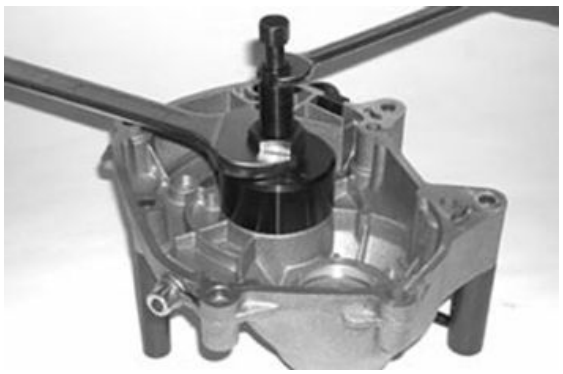


Specific tooling

001467Y006 Pliers to extract 20 mm bearings

001467Y035 Bearing housing, external ø 47 mm

- Support the hub cover using the stud bolt set.
- Pull out the bearing using the special tool.



Specific tooling

020476Y Stud bolt set

001467Y006 Pliers to extract 20 mm bearings

001467Y007 Driver for OD 54-mm bearings

Removing the wheel axle bearings

- Take out the clip on the outside of the gearbox cover.

- Support the hub cover using the stud bolt set.
- Pull out the bearing using the special tool.

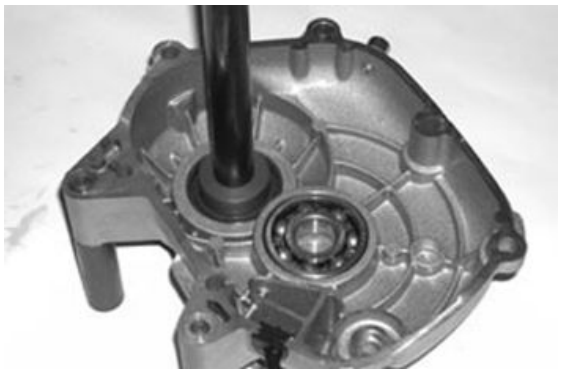
Specific tooling

020476Y Stud bolt set

020376Y Adaptor handle

020477Y Adapter 37 mm

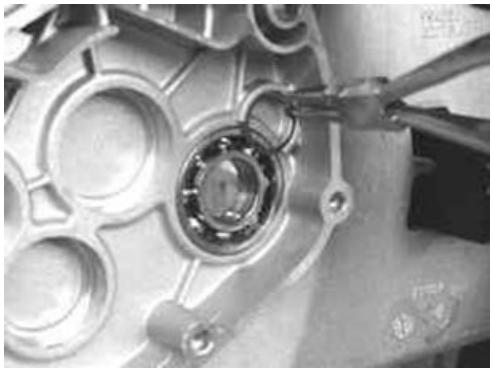
020483Y 30-mm guide



- Remove the oil guard using a screwdriver.

Removing the driven pulley shaft bearing

- If you have to remove the driven pulley shaft, the relevant bearing and the oil guard, remove the transmission cover and the clutch unit as described in the « Automatic transmission» chapter.
- Extract the driven pulley shaft from its bearing.
- Remove the oil guard using a screwdriver into the hub gear box.
- Remove the Seeger ring shown in the figure.



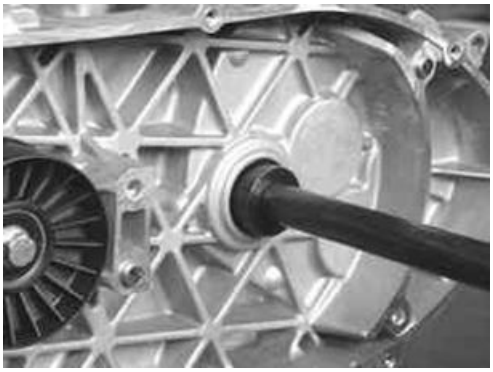
- Pull out the driven pulley shaft bearing from the engine crankcase using the special tool.

Specific tooling

020376Y Adaptor handle

020358Y 37 x 40 mm Adaptor

020364Y 25-mm guide



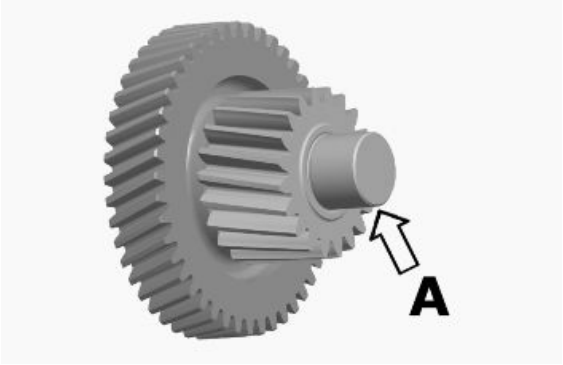
Inspecting the hub shaft

- Check that the 3 shafts exhibit no wear or deformation on the grooved surfaces, at the bearings and at the oil seals.
- In case of faults, replace the damaged parts.

Characteristic

Connection diameter for countershaft:

A = diameter 20 - 0.01 -0.02 mm

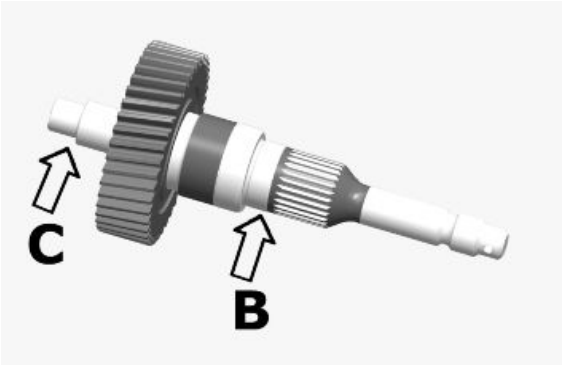


Characteristic

Connection diameter for wheel shaft:

B = diameter 30 - 0.010 -0.023 mm

C = diameter 15 - 0.01 -0.02 mm



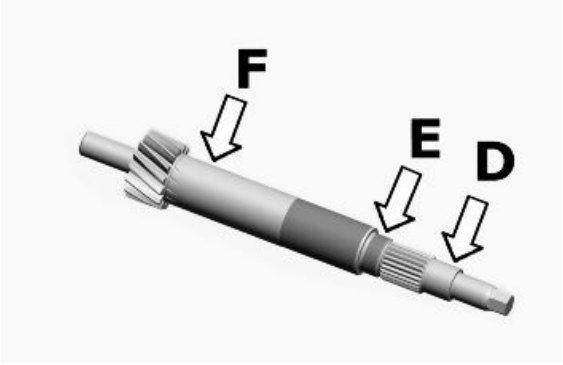
Characteristic

Bearing diameter for shaft driven pulley:

D = diameter 17 - 0.01 -0.02 mm

E = diameter 20 - 0.01 -0.02 mm

F = diameter 25 - 0.01 -0.02 mm



Inspecting the hub cover

- Check that the mounting surface is not damaged or deformed.

- Check the capacity of the bearings.

In case of faults, replace the hub cover.

Refitting the driven pulley shaft bearing

- Heat the crankcase using the heat gun.

Specific tooling

020151Y Air heater

- Insert the driven pulley shaft bearing until it abuts against the bottom of the seat using the special tool.

N.B.

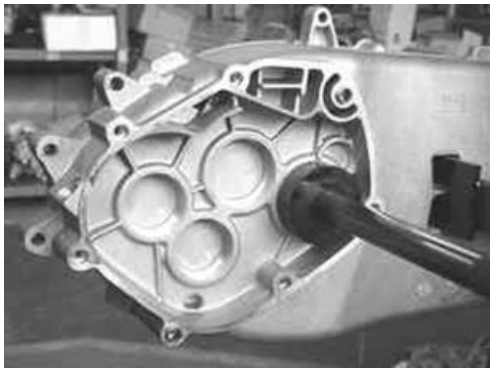
PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

020376Y Adaptor handle

020360S 52 x 55 mm adaptor

020364Y 25-mm guide



- Heat the intermediate gear bearing seat.

- Insert the intermediate shaft bearing using the special tool.

N.B.

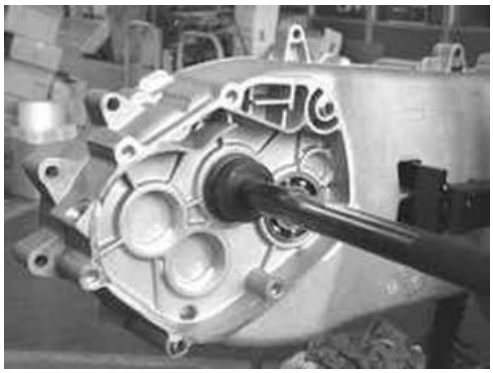
PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

020376Y Adaptor handle

020359S 42 x 47 mm Adaptor

020363Y 20-mm guide



- Heat the gear shaft bearing seat on the crankcase.
- Insert the gear shaft bearing in the upper crankcase seat using the special tool.

N.B.

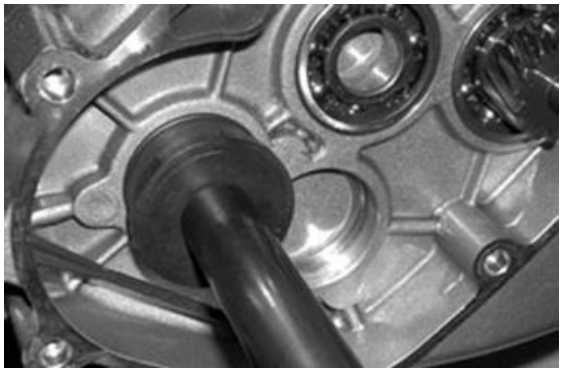
PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

020376Y Adaptor handle

020359S 42 x 47 mm Adaptor

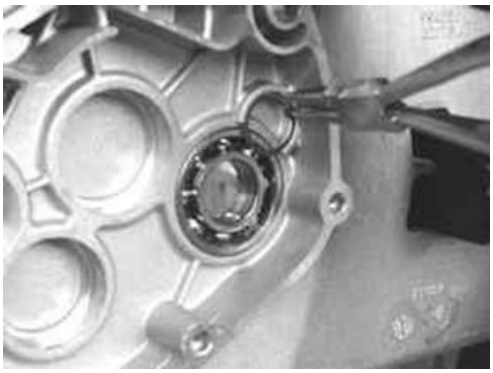
020412Y 15-mm guide



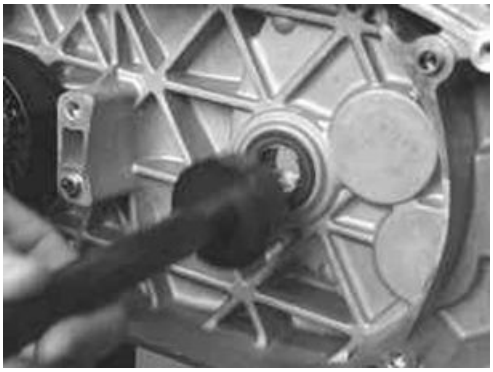
- Place the safety lock Seeger ring of the driven pulley shaft bearing.

N.B.

PLACE IT IN THE POSITION SHOWN IN THE FIGURE.



- Insert the pulley shaft oil guard on the transmission side.



Refitting the hub cover bearings

- Heat the bearing seats on the cover using the heat gun.
- Support the hub cover using the stud bolt set.

Specific tooling

020151Y Air heater

020476Y Stud bolt set

- Insert the intermediate shaft bearing on the cover using the special tool.

N.B.

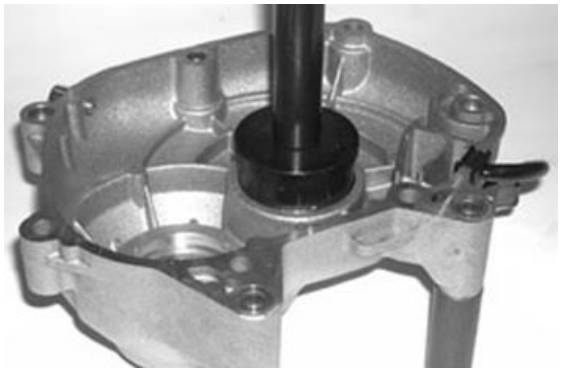
PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

020376Y Adaptor handle

020360S 52 x 55 mm adaptor

020363Y 20-mm guide



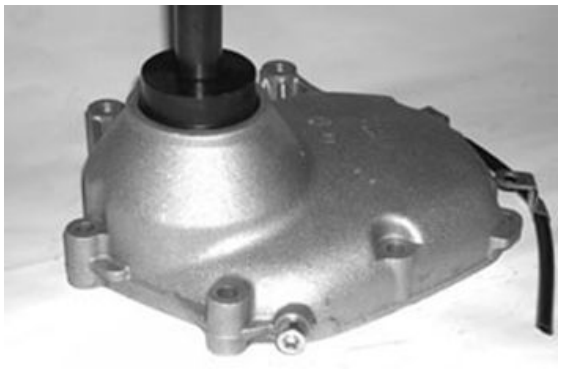
- Heat the gear shaft bearing seat from the cover outside.
- Insert the gear shaft bearing on the cover using the special punch until abutment.

Specific tooling

020376Y Adaptor handle

020360S 52 x 55 mm adaptor

020483Y 30-mm guide



- Replace the snap ring

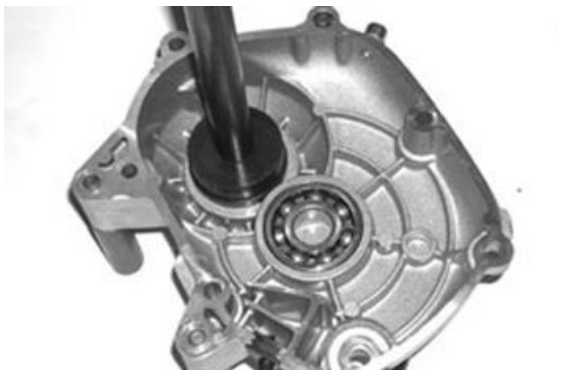
- Support the hub cover using the stud bolt set.
- Insert the wheel shaft oil guard with the sealing lip facing the inside of the cover.
- Place the oil guard flush with the crankcase.

Specific tooling

020376Y Adaptor handle

020360S 52 x 55 mm adaptor

020476Y Stud bolt set



Refitting the hub bearings

- Place the 3 shafts as shown in the figure.

Refitting the ub cover

- Check the proper position of the centring dowels.
- Install a new gasket.
- Fit the gearbox cover, making sure the breather pipe is in the correct position.

- Position the fixing screws according to the position noted during disassembly.

4 long screws

3 short screws

- Tighten the screws to the specified torque, paying attention to the positioning of the clamps of the breather pipe , as shown in the figure.

Locking torques (N*m)

Rear hub cover screws 24 to 27

- Position the hub oil drain screw and tighten it to the specified torque.
- Refill with the prescribed oil to the Max. level.

Recommended products

Transmission oil 80W-90 Lubricant for gearboxes and transmissions.

SAE 80W-90; API GL-4

Locking torques (N*m)

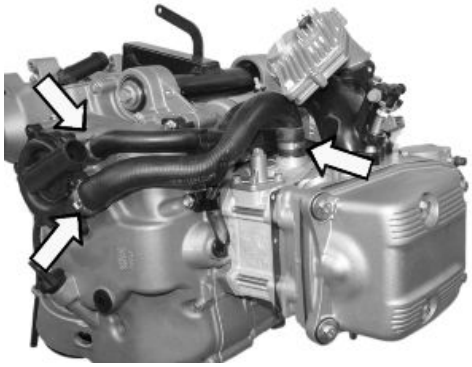
Hub oil drain screw 15 to 17 (11 to 12.5 lb*ft)

Flywheel cover

- Remove the 4 pipe clamps for an easier removal of the flywheel cover, remove the feed hoses and disconnect the return hose from the pump cover.

N.B.

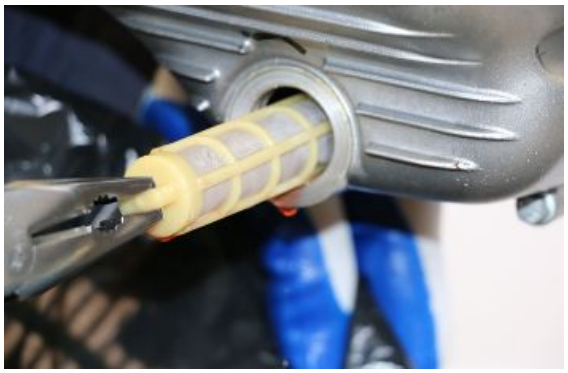
THE BANDS MUST BE REPLACED. TO REMOVE THEM, OPEN WITH A SCREWDRIVER OR CUT THEM.
BE CAREFUL NOT TO DAMAGE THE PLASTIC UNIONS.



Removing the hub cover

- Drain the engine oil by removing the drainage cap.
- Prepare a suitable container to collect the oil.

- Remove the pre-filter.



- Remove the oil filter using a filter tape or shaped cup wrench.

- Unscrew the 13 fixing screws of the flywheel cover, paying attention to the different lengths:

1 central screw 75 mm

9 medium screws 40 mm

3 short screws 31 mm

N.B.

THE FIXING SCREWS ARE OF DIFFERENT LENGTHS, TAKE NOTE OF THEIR RESPECTIVE POSITIONS.

- Remove the flywheel cover with the relevant gasket and the cooling system sleeve support.

CAUTION

REMOVE THE COVER AVOIDING ANY POSSIBLE INTERFERENCE BETWEEN STATOR AND ROTOR.

CAUTION

BE CAREFUL TO PREVENT SLIPPAGE OF THE BY-PASS VALVE AND OF THE RELEVANT SPRING.

Removing the flywheel cover components

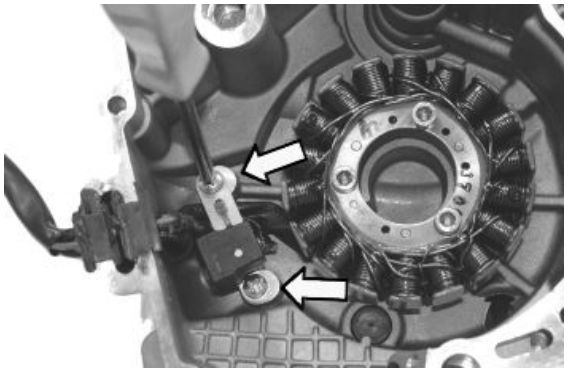
- Unscrew the fastening screws and remove the water pump cover.

6 Torx T25 screws

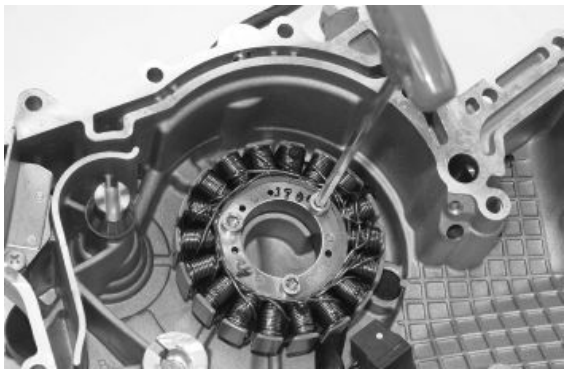
- Remove the by-pass and the relevant spring.
- Remove the oil pump seal.

Removing the stator

- Remove the two retaining screws and the cable guide bracket.



- Unscrew the 3 fastening screws and remove stator and its wiring.



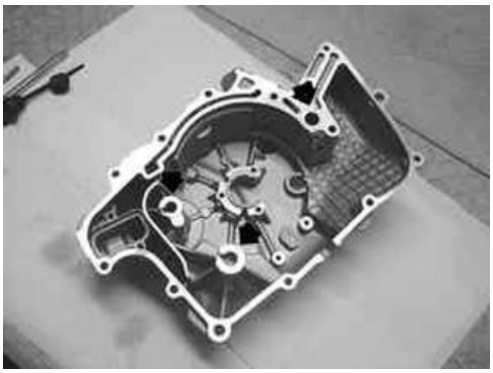
Inspecting the cover components

- Loosen the two retaining screws and remove the reed valve support with bulkhead.

- Remove the blow-by reed valve with the relevant sealing gasket.

- Unscrew the fastening screw and remove the gas outlet union with the relevant O-ring.

- Check that the mounting surface of the crankcase is not worn or deformed.
- Check that the by-pass valve seat, the torque limiter and the water pump shaft are free from wear.



Characteristic

By-pass housing hole diameter:

13.9 mm

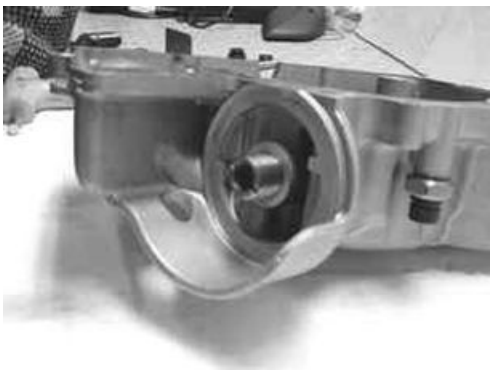
Connection diameter for start-up gear shaft:

12 mm

Connection diameter for pump shaft:

8 mm

- Check that the oil filter union and matching surface exhibit no deformations or wear.



- Check the condition of the stator and the relevant cable harness.

- Check the continuity between the 3 phases.

N.B.

VALUES ARE STATED AT AMBIENT TEMPERATURE. A CHECK WITH THE STATOR AT OPERATING TEMPERATURE MAY RESULT IN VALUES HIGHER THAN THOSE STATED.

Electric characteristic

Resistance:

0.2 - 1 Ω

- Check the ground insulation of each phase.
- If a fault is found, carry out a thorough check of the cable harness that contains two types of cable: Rigid cables close to the stator and flexible cables close to the connector.

- Check that the winding is positioned so as not to interfere with the heads of the retaining screws.

Refitting the stator

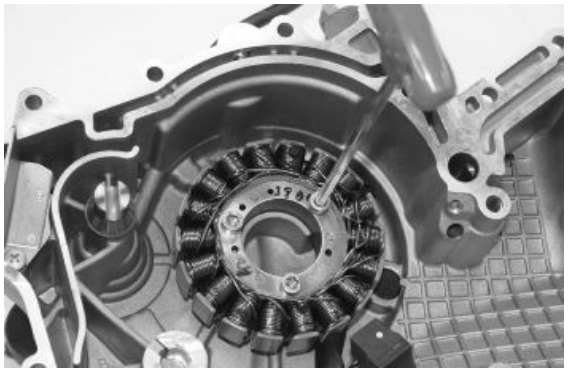
- Install the stator assembly together with the wiring harness, tightening the 3 screws to the prescribed torque.

N.B.

INSERT THE RUBBER WIRING SEALING GASKET INTO THE SPECIAL SEAT ON THE CRANKCASE.

Locking torques (N*m)

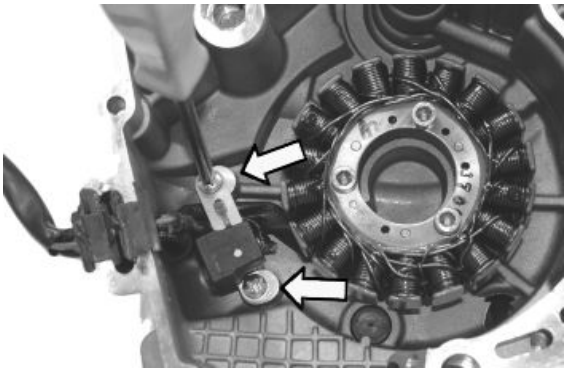
Stator clamps **8 - 10**



- Install the wiring guide bracket tightening the 2 screws to the prescribed torque.

Locking torques (N*m)

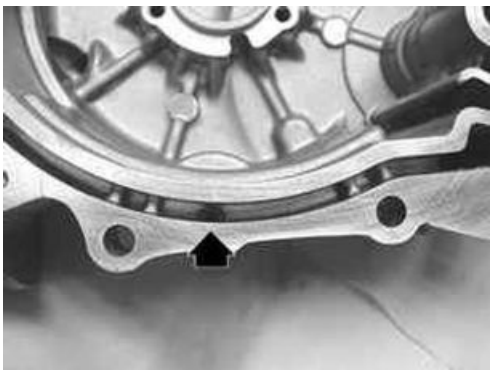
Stator cable harness guide bracket screws 3 - 4



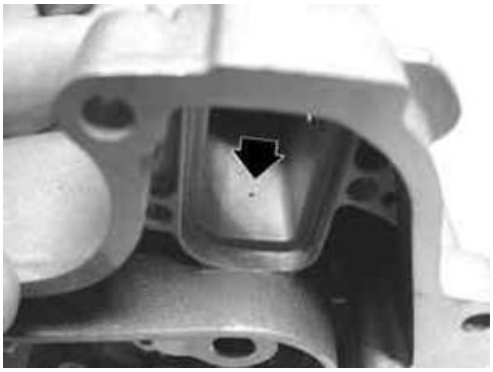
Refitting the flywheel cover components

- Before reassembling, check that all components are perfectly clean.
- For the cover, carefully check all lubrication channels, in particular:
- The 3 by-pass channels.

- Oil pressure sensor feeding duct.



- Oil vapour decantation chamber



- Temporarily install the distribution timing check hole cover and the engine oil filling cap/bar.
- Insert the blow-by recovery duct using a new O-ring.
- Tighten the screws to the prescribed torque.

Locking torques (N*m)

Blow-by recovery duct fixing screws 3 - 4

- Insert the spring and the by-pass piston on the flywheel cover.

N.B.

LUBRICATE THE BY-PASS VALVE.

- Reinstall the blow-by reed valve using a new sealing gasket.
- Reinstall the support with head and tighten the screws to the prescribed torque.

Locking torques (N*m)

Supporting screws with bulkhead 0.3 ÷ 0.4

- Correctly fit a new O-ring, do not allow it to come into contact with grease or oil.

FAILURE TO OBSERVE THIS PRECAUTION WILL IRRETRIEVABLY DEFORM THE O-RING.

- Refit the water pump cover and tighten the 6 fixing screws to the prescribed torque.

Locking torques (N*m)

Pump cover fixing screws: 3 ÷ 4

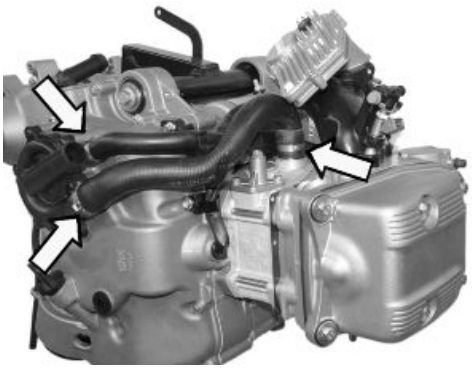
Refitting the flywheel cover

- Install a new oil filter, lubricate the gasket, screw on and finally tighten to the prescribed torque.

Locking torques (N*m)

Engine oil filter 12 - 16

- Install the supply hose to the cylinder and connect the return hose to the pump cover using new clamps.



N.B.

TIGHTEN THE CLAMPS USING APPROPRIATE PLIERS, PAYING ATTENTION NOT TO CONSTRICT THE HOSES BUT ALSO TAKING CARE TO TIGHTEN THE CLAMPS SUFFICIENTLY.

- Install the pre-filter again and insert the engine oil drain plug, tightening to the prescribed torque.
- Refill the engine with the prescribed type of oil.

Recommended products

Engine oil 5W -40 Synthetic-based lubricant for four-stroke engines.

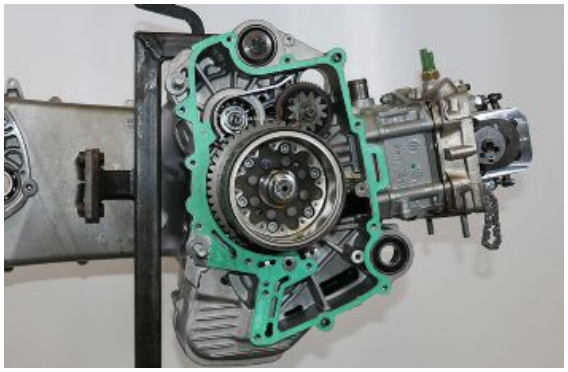
SAE 5W-40; JASO MA, MA2; API SL; ACEA A3

Locking torques (N*m)

Engine oil drainage plug 24 to 30

- Lubricate the intermediate gear seat with torque limiter on the flywheel cover.
- Align the water pump movement sensor with a reference and install the flywheel cover as described in the Flywheel cover chapter.

- Install a new gasket on the engine crankcase.
- Check the presence of the three centring dowels.

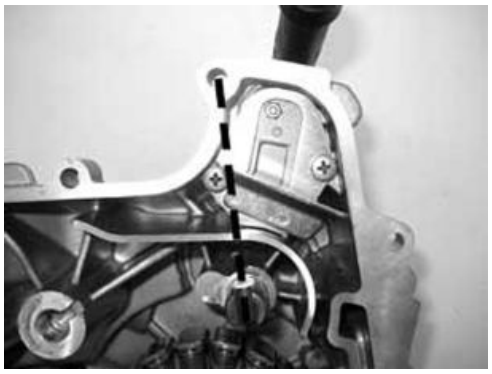


- Turn the crankshaft in order to align the countershaft movement sensor with a reference point on the crankcase (see figure).

- Repeat the alignment for the water pump crankshaft using the same reference point on the engine.

N.B.

THIS PREPARATION IS USEFUL PARTICULARLY IN THE EVENT OF REPAIRS WITH THE WATER PUMP COVER INSTALLED.



- Install the flywheel cover on the engine, paying attention to avoid interference between the stator and rotor.

WARNING

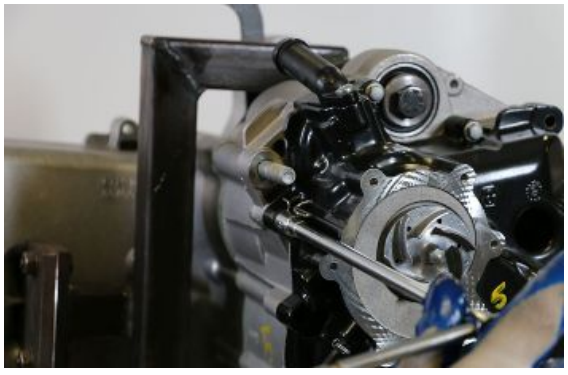
FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN DESTRUCTION OF THE CERAMIC MAGNETS.

- Fix the flywheel cover fixing screws according to the position noted during disassembly, paying attention to the correct assembly of the oil pressure sensor cable gland and the sleeve support.

1 central screw 75 mm

9 medium screws 40 mm

3 short screws 31 mm

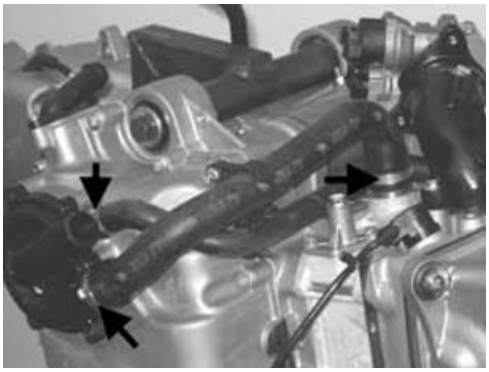


Locking torques (N*m)

Flywheel cover screws **11 - 13 Nm (8 -10 lb*ft)**

Flywheel and starting

- Remove the three bands shown in the figure for an easier removal of the flywheel cover, remove the feed hoses and disconnect the return hose from the pump cover.

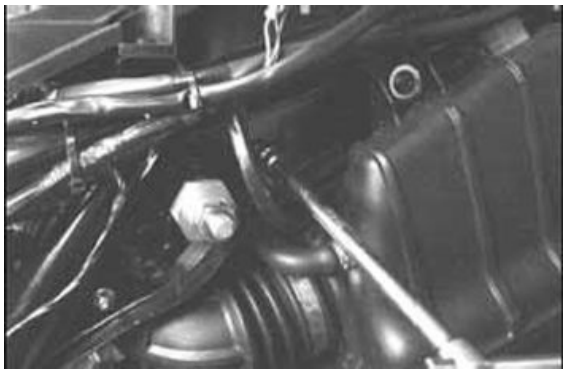


N.B.

THE BANDS MUST BE REPLACED. TO REMOVE THEM, OPEN WITH A SCREWDRIVER OR CUT THEM.
BE CAREFUL NOT TO DAMAGE THE PLASTIC UNIONS.

The starter is sold as a complete part.

Before deciding to replace it, carry out the following tests:



1 - Battery

Check the voltage after not running (a few hours):

Voltage >12.5V

Check the density of the electrolyte of each cell:

Bé = 30 ÷ 32

Specific weight: 1.25 - 1.26

YES go to 2 NO go to 3

2 - Make sure the negative terminals (battery negative and starter negative) are correctly connected to each other and to the frame.

YES go to 4 NO go to 5

3 - Recharge and if necessary replace the battery.

4 - Connect the diagnostic tester (see chapter "Injection system").

Connect the induction clamp of an ammeter to the positive power supply cable of the starter motor.

Remove the 10A fuse no. 12 (see "fuses" chapter).

Switch in position "ON" with interrupt switch in position "RUN" and side stand raised.

Select the "PARAMETERS" function.

Start the engine (so that it cannot move) long enough to measure the rpm and starter absorption.

N.B.

THE DECLARED RPM VALUE IS THAT INDICATED BY THE TESTER, THE RPM READING IS NOT THE REAL ONE, BUT IS VALID FOR DIAGNOSTIC PURPOSES.

Specific tooling

020922Y Diagnosis Tool

Electric characteristic

Absorption at trailing speed:

80 - 120 A

Revolution speed =

approx. 300-400 rpm

YES go to 6 NO go to 7 NO go to 8 NO go to 9

5 - Restore the connections

6- **The values are correct.**

Finally carry out a check of the power consumption at idle speed.

Remove the starter motor (see the flywheel and starter system).

Reconnect the earth and positive and perform the test.

Electric characteristic

Current consumption at idle speed:

<40 A

YES go to 10 NO go to 11

7- **Low trailing speed**

High electrical absorption

Carry out a test of the engine rotation (example: possible melting of the bushes) and if no anomalies are found, replace the starter motor.

8- **Low trailing speed**

Low electrical absorption

Repeat the test, bridging the power terminals of the starter remote control switch or even better replacing them.

Check the new values.

YES go to 12 NO go to 13

9 - High trailing speed

Low electrical absorption

The engine turns too freely, check the compression end pressure.

If the values are not correct proceed as follows.

10 - The starter motor works properly.

11 - Check the rotation of the armature.

12 - Replace the starter remote control switch.

13 - Test the battery again and if necessary replace the starter motor.

N.B.

IF THE TRAILING SPEED OF THE CRANKSHAFT IS LOW AND COMBINED WITH STRANGE NOISE, CHECK THE FREEWHEEL OF THE TORQUE LIMITER (SEE THE "FLYWHEEL AND STARTER SYSTEM" CHAPTER).

STARTER MOTOR

Specification	Desc./Quantity
Type	Mitsuba sm13d
Power	0.9 kW

BATTERY

Specification	Desc./Quantity
Capacity	14 Ah
Starting current	125 A

START-UP REMOTE CONTROL SWITCH

Specification	Desc./Quantity
Type	SEALED
Maximum load	150 A continuous

STARTER TRANSMISSION

Specification	Desc./Quantity
Ring gear and freewheel coaxial to the flywheel.	Intermediate gear with built-in torque limiter.

The starter system has a transmission between the motor armature and engine shaft equipped with freewheel coaxial to the flywheel and torque limiter on the intermediate shaft.

The limiter is calibrated to 10 kgm (100 Nm); this component protects the structure of the engine and the starter kinematic mechanism in the event of incorrect starting with consequent inverse rotations.

The freewheel is used for a sufficiently silent starting.

The starter control (energised remote control) is slaved to enabling signals by the side stand and the emergency OFF/RUN switch, which does not allow starting given dangerous conditions.

The starter control circuit is not controlled by the immobilizer system, therefore before insisting on the starter system, check the consensus of the immobilizer.

In order to check the enabling switches circuit, see the «Electrical system» chapter, whereas to check the engine shaft control transmission, follow what is described in the «Flywheel and starter system» chapter.

Removing the starter motor

N.B.

THIS OPERATION MAY ALSO BE CARRIED OUT WITH FLYWHEEL COVER ASSEMBLED.

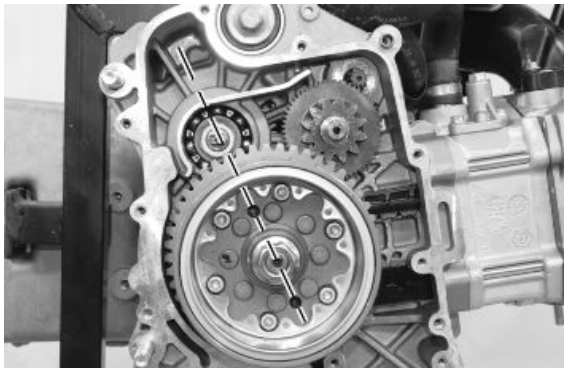
- Unscrew the fixing screws.

2 screws

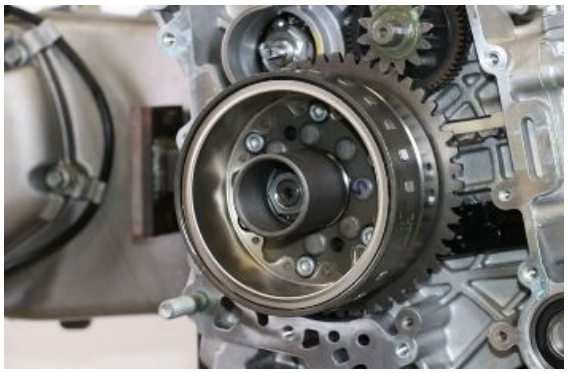
- Remove the ground cable and the pipe support bracket, then remove the complete starter motor.

Removing the flywheel magneto

- Align the holes obtained on the flywheel with the crankcase housing to allow the introduction of the special tool.



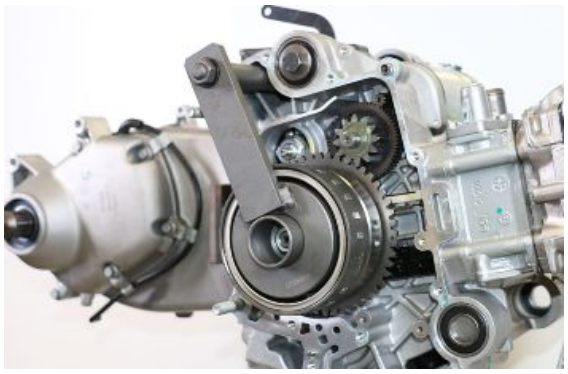
- Tighten the bushing of the flywheel lock tool on the removing tool threading.



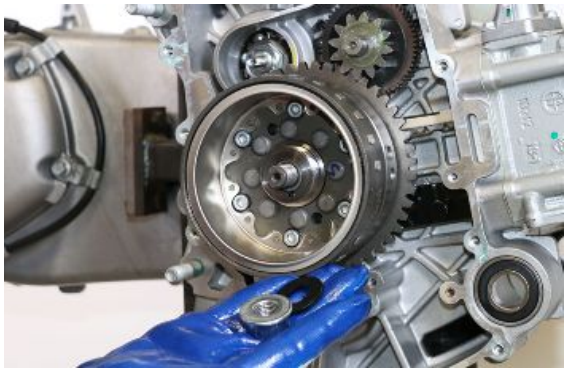
- Insert the special tool as shown in the figure, making sure that the pins are perfectly inserted into the previously aligned holes and that it is perfectly abutted and almost flush with the flywheel.

Specific tooling

020472Y Flywheel lock tool



- Loosen the magneto flywheel fastening nut.
- Remove the specific tool, the fixing nut and the washer below.
- Insert the nut again so as to slightly uncover the shaft and free the space that was occupied by the washer.



CAUTION

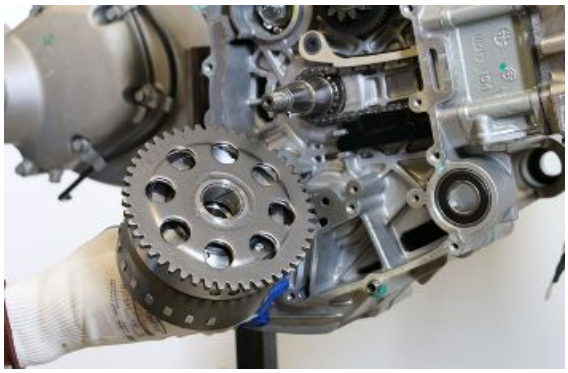
THIS OPERATION IS REQUIRED AS THE FLYWHEEL IS STRONGLY LOCKED; THE CONE DETACHMENT MAY THEREFORE CAUSE THE ROTOR SLIPPAGE, WITH THE CONSEQUENT BREAKAGE OF THE MAGNETS.

- Insert the special removing tool.
- Using a 27-mm wrench and a 19-mm bushing, release the flywheel.

Specific tooling

020467Y Flywheel extractor

- Remove the extractor.
- Remove the nut and extract the flywheel with the start-up rim.
- Remove the crankshaft key.



- To remove the start-up rim from the freewheel it is necessary to turn it clockwise and pull it out.

- Remove the freewheel from the flywheel by loosening the 6 fastening screws.

SINCE THE FREEWHEEL MUST BE REMOVED, IT IS ADVISABLE TO LOOSEN THE 6 FASTENING SCREWS IN ADVANCE WITH THE FLYWHEEL STILL INSTALLED ON THE CRANKSHAFT.

- The freewheel is coupled to the flywheel with high precision; if removal is difficult, use 2 screws as gripping points and as removing tools, if required.

- Extract the intermediate gear provided with torque limiter.

Inspecting the flywheel components

- Check the integrity of the magnets.
- Check that the magnet support cage is free from deformation or cracks.
- Check that the flywheel splines exhibit no loosening.

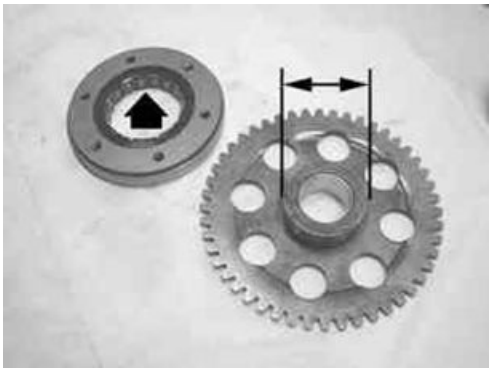
Starter gear rim

- Check that there is no wear or abnormal impressions on the "rollers" of the freewheel and on the surface of the starter ring gear hub.
- Check the hub outside diameter.

Characteristic

Hub outside diameter:

Diameter 45.665 + 0.008 +0.005 mm



- Check the inside diameter of the bushing of the starter gearing.
- Check that the toothing is not worn.

Characteristic

Inside diameter of the bushing:

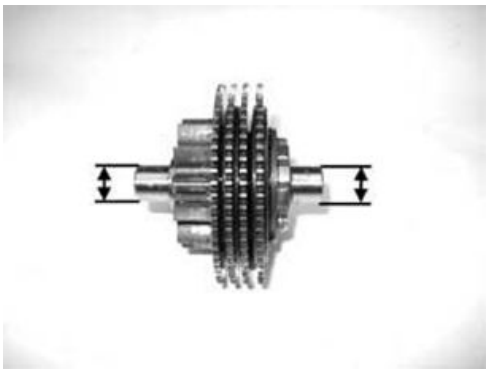
Diameter 27 + 0.020 +0.041 mm

N.B.

IF THE FAULTS DISCOVERED AFFECT THE HUB, REPLACE THE STARTER RING GEAR AND FREEWHEEL.
IF ONLY THE BUSHING IS WORN, IT IS POSSIBLE TO REPLACE ONLY THE COMPLETE STARTING RING GEAR. IN THAT CASE, CHECK ALSO THE DIAMETER AND THE SURFACE OF THE CONNECTION ON THE CRANKSHAFT. IN CASE OR IRREGULARITIES, REPLACE THE CRANKSHAFT.

Intermediate gear

- Check that the toothing is not worn.
- Check the diameter of the two bearings.

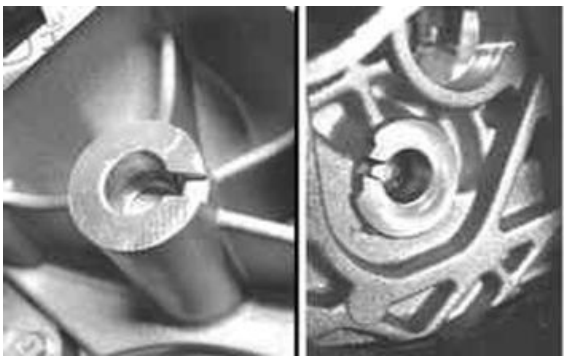


Characteristic

Gear bearing diameter:

12 - 0 0.011 mm

Also check the shaft diameter on the flywheel cover and on the engine crankcase.



Characteristic

Bearing diameter on the flywheel cover

12 + 0.034 -0.016 mm

Bearing diameter on the engine crankcase:

12 + 0.034 -0.016 mm

N.B.

THE TORQUE LIMITER IS PROVIDED WITH 4 GEARS THAT HAVE THE FUNCTION OF CLUTCH DRIVE PLATES.

Driven plates consist of 4 Belleville springs provided with grooved profiles; this assembly allows transmitting torque lower than 10 kg.
In case of incorrect start-up manoeuvres, the limiter prevents any kicks, with consequent reversal of direction of the crankshaft which would impair the engine structure.

The limiter assembly cannot be overhauled. In case of irregularities on the toothed discs, replace the assembly.

Refitting the free wheel

- Make sure the freewheel contact surfaces are in good condition.
- Thoroughly clean the free wheel to remove LOCTITE residue.
- Degrease the threading of the holes in the free wheel and the clamping screws.
- Apply the recommended product to the end of the screws.

Recommended products

Loctite 243 Medium strength thread-locking sealant.

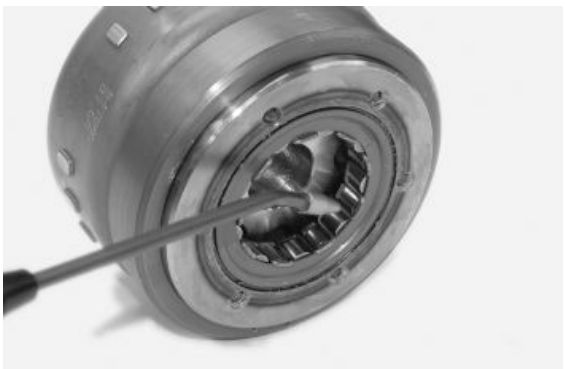
Blue

- Fit the freewheel on the magneto flywheel making sure that the ground side is in contact with the flywheel itself, i.e. with wheel Seeger ring visible.
- Lock the six clamping screws in criss-cross fashion to the prescribed torque.

Locking torques (N*m)

Screw fixing freewheel to flywheel **13 - 15**

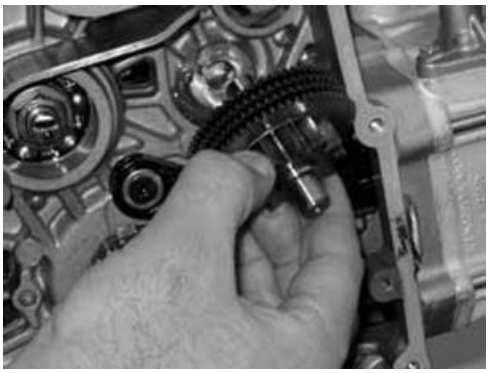
- Oil the free wheel "rollers".



Refitting the intermediate gear

- Lubricate the gear housing on the engine crank-case.

- Insert the intermediate gear with torque limiter



- Lubricate the inside bushing and the starter ring gear hub surface.

- Install the start-up rim on the flywheel turning it clockwise and inserting at the same time.

Refitting the flywheel magneto

- Insert the key on the crankshaft.
- Install the flywheel checking the proper insertion of the key and engaging the torque limiter gear with the start-up rim.

- Insert washer and nut on the crankshaft.

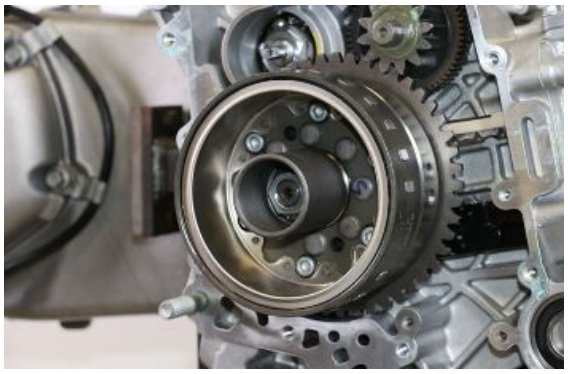
- Tighten thoroughly the guide bushing of the flywheel lock tool and loosen by 1/4 turn.

N.B.

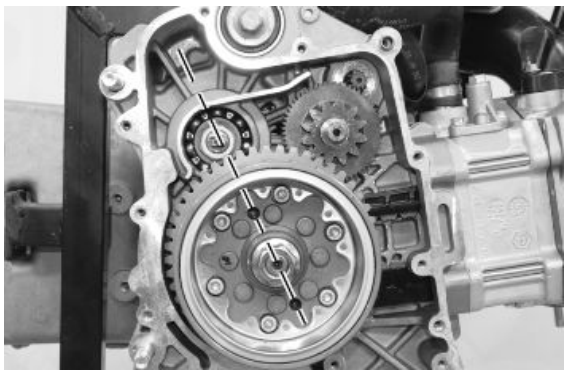
FAILURE TO OBSERVE THIS PRECAUTION CAUSES THE LOCKING OF THE GUIDE ON THE FLYWHEEL.

Specific tooling

020472Y Flywheel lock tool



- Align the 2 holes of the flywheel with the case housing to allow the introduction of the special tool.



- Insert the special tool checking that the pins are perfectly introduced into the seat.

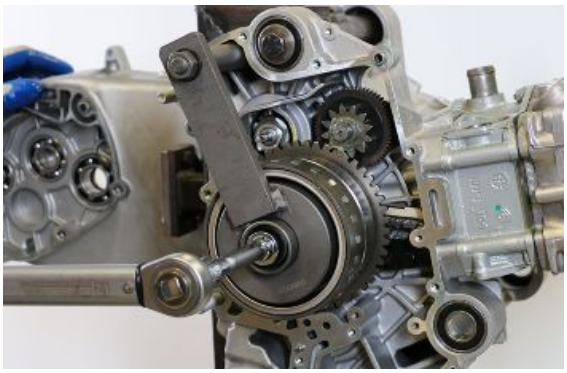
Specific tooling

020472Y Flywheel lock tool

- Tighten the flywheel lock nut to the prescribed torque.

Locking torques (N*m)

Flywheel fixing nut 115 - 125



Refitting the starter motor

- Check that the O-ring is in good working order and lubricate it.
- Insert the starter motor.
- Fit the fixing screws with the ground cable and the pipe support bracket, as shown in the photo.

2 screws

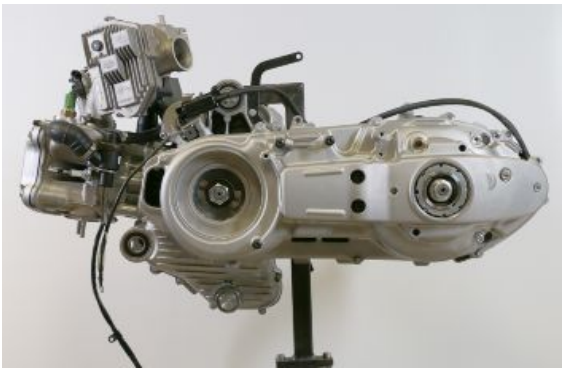
- Tighten the screws to the prescribed torque.

Locking torques (N*m)

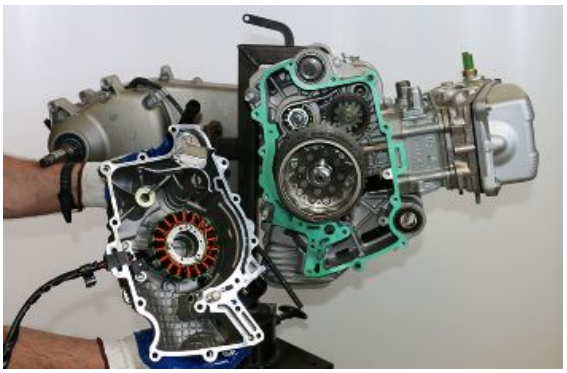
Starter screws 11 to 13

Cylinder assy. and timing system

- Remove the external and internal transmission cover.

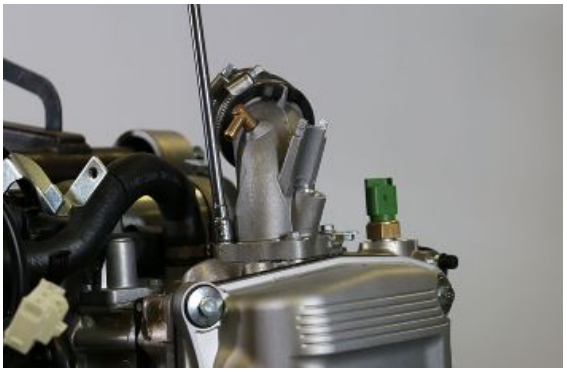


- Remove the flywheel cover, the flywheel and the torque limiter.



Removing the intake manifold

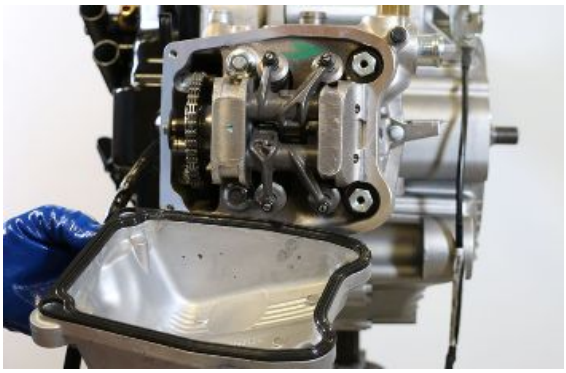
- Remove the 3 mounting screws.
- Remove the intake manifold unit.



Removing the rocker-arms cover

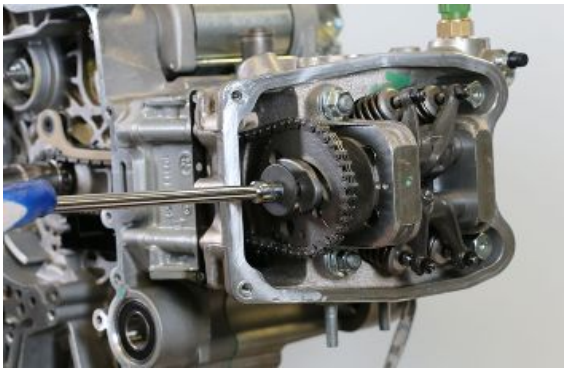
Unscrew and remove the 4 flanged screws to remove the tappet cover .

- Lift the tappet cover and pay attention to the gasket.



Removing the timing system drive

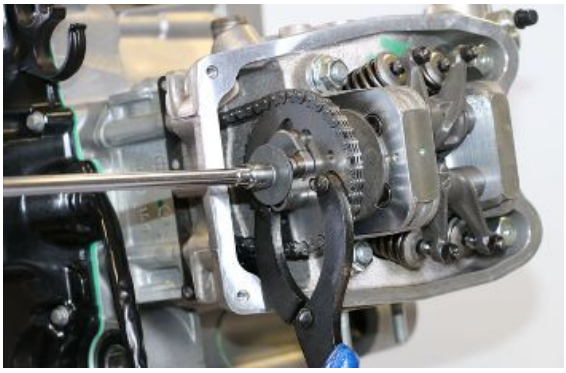
- Turn the engine to close the intake valves.



- Remove the central screw and the valve lifting device mass stop bell using the special tool.

Specific tooling

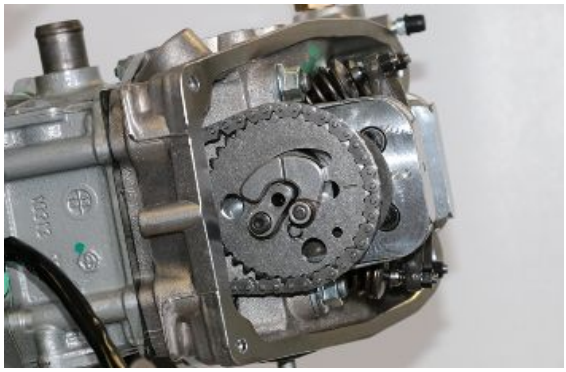
020565Y Flywheel lock calliper spanner



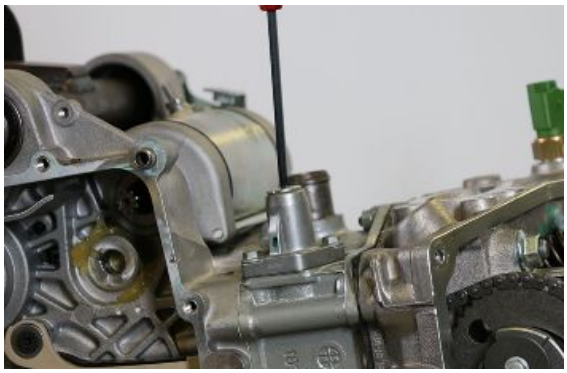
- Remove the return spring and the valve lifting mass with relevant travel end washer.
- Align the reference marks on the timing chain rim with those on the head, as shown in the photo.

N.B.

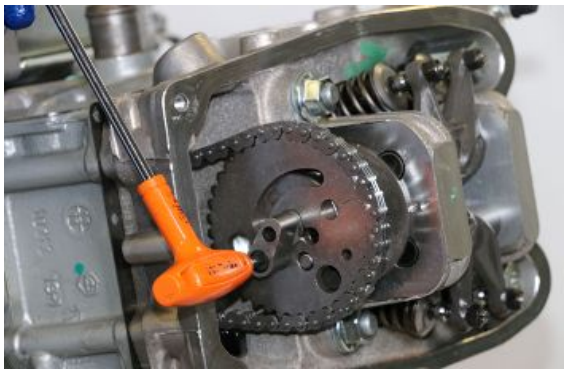
BE CAREFUL NOT TO ALLOW THE WASHER AND SPRING TO FALL INTO THE ENGINE THROUGH THE CHAIN COMPARTMENT.



- Loosen the central screw on the tensioner first.
- Unscrew the 2 fastening screws and remove the tensioner with relevant gasket.



Remove the inside hexagon screw and the counterweight as shown in the figure.



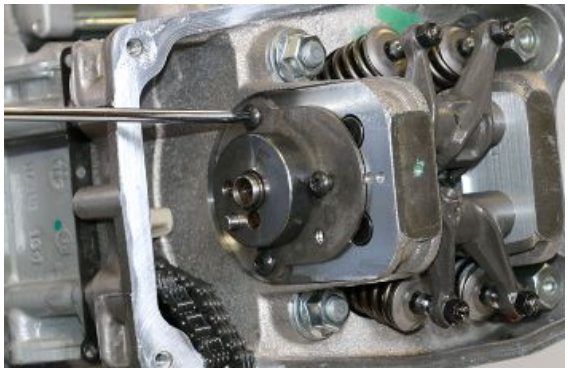
- Remove the timing belt rim from the camshaft.
- Remove the timing belt rim.

Removing the cam shaft

- Unscrew the 3 fastening screws and remove camshaft retaining bracket.

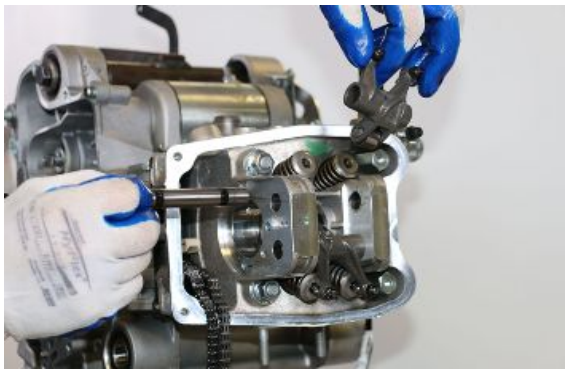
N.B.

REMOVING THE FASTENING SCREWS MAY BE DIFFICULT. BE CAREFUL NOT TO DAMAGE THE INSIDE HEXAGON. IF NECESSARY, SEPARATE THE THREADS IN ADVANCE.



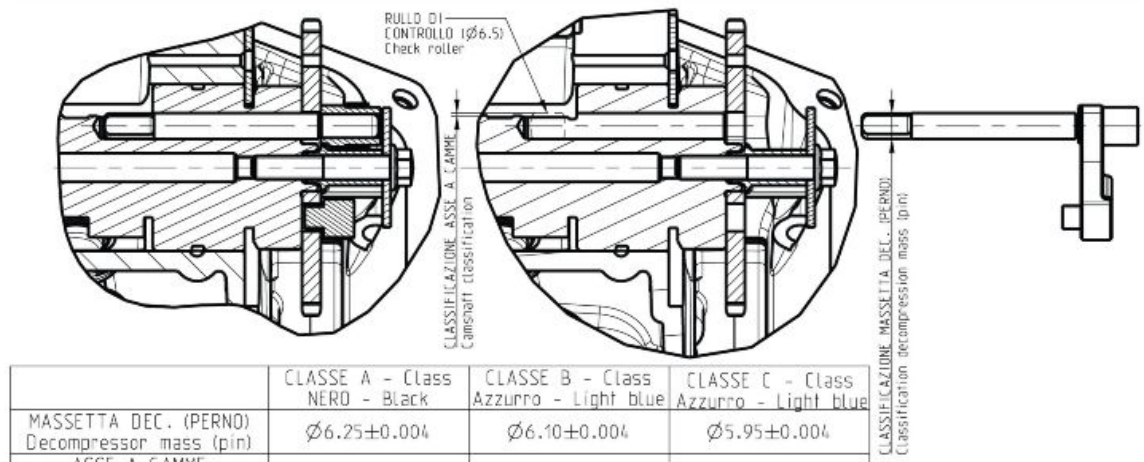
- Remove the camshaft.

- Remove pins and rocking levers by the transmission side holes.



CLASSIFICATION OF DECOMPRESSION PIN/SCREW KNOB - CAMSHAFT

MASSETTA DECOMPRESSORE (PERNO)-ASSE A CAMME (SOLO PER LE MOTORIZZAZIONI CHE UTILIZZANO LA CLASSIFICAZIONE)
Decompressor mass (pin) - camshaft (only for engine version that provide it)



	CLASSE A - Class NERO - Black	CLASSE B - Class Azzurro - Light blue	CLASSE C - Class Azzurro - Light blue
MASSETTA DEC. (PERNO) Decompressor mass (pin)	Ø6.25±0.004	Ø6.10±0.004	Ø5.95±0.004
ASSE A CAMME Camshaft	0.61 - 0.68	0.68 - 0.76	0.71 - 0.78

ABBINAMENTO CLASSI Clases match		MASSETTA DECOMPRESSORE (PERNO) Decompressor mass (pin)		
		CLASSE A - Class	CLASSE B - Class	CLASSE C - Class
ASSE A CAMME Camshaft	CLASSE A - Class	A - A	NO	NO
	CLASSE B - Class	NO	B - B	NO
	CLASSE C - Class	NO	NO	C - C

CLASSIFICATION OF DECOMPRESSION SCREW KNOB (PIN) - CAMSHAFT

	Class A (black)	Class B (light blue)	Class C (light blue)
Decompression screw knob (pin)	Ø 6,25 ± 0,004	Ø 6,10 ± 0,004	Ø 5,95 ± 0,004
Camshaft	0,61 - 0,68	0,68 - 0,76	0,71 - 0,78

CLASS MATCHING

	Decompression screw knob (pin) - Class A	Decompression screw knob (pin) - Class B	Decompression screw knob (pin) - Class C
Camshaft - Class A	A - A	NO	NO
Camshaft - Class B	NO	B - B	NO
Camshaft - Class C	NO	NO	C - C

Decompression pin/screw knob

- Class identification sign: A - B - C
- Stamp of the class identification sign: pin end

Camshaft

- Class identification sign: A - B - C
- Stamp of the class identification sign: camshaft - sprocket timing view

N.B.

THE CLASSES OF THE TWO COMPONENTS MUST BE IDENTICAL.

Check the combustion chamber's pressure during the ignition so that it ranges between the accepted values listed below and also check the engine's revolutions.

Perform the check when the battery is loaded, at room temperature and use a pressure gauge to detect the (relative) pressure during the ignition and the corresponding engine revolutions.

CHECK PRESSURE OF THE COMBUSTION CHAMBER DURING IGNITION

	Engine speed (RPM)	Relative pressure (bar)
MIN	415	5,2
MAX	460	8,7

Removing the cylinder head

- Remove the spark plugs.
- Remove the cooling system outlet sleeve with thermostat.

- Remove the 2 fastening nuts on the head, on the exhaust and on the intake side.

- Remove the two M6 screws into the distribution channel and the M6 screw on the spark plug side with the thermostat support.

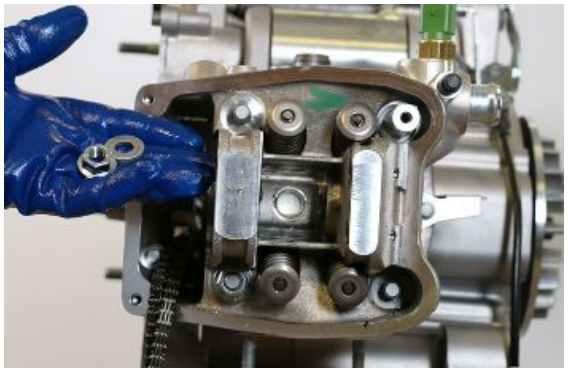
N.B.

THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, ROCKING LEVER PINS AND FITTING BRACKET IF NECESSARY.

- Loosen the 4 head-cylinder fastening nuts in 2 or 3 times and in a crossed sequence.
- Remove the head, the 2 centring dowels, the gasket and the lower chain guide sliding block.

N.B.

DO NOT REMOVE THE DOWELS IF THEY ARE FORCED INTO THEIR SEAT.



CAUTION

WHEN YOU HAVE TO REMOVE THE HEAD, PREPARE A SUITABLE CONTAINER SINCE THE THERMAL GROUP CONTAINS COOLANT.

Removing the valves

- Using the appropriate tool fitted with an adaptor, remove the cotters, caps, springs and valves.

Specific tooling

020382Y Valve cotters equipped with part 012 removal tool

020382Y012 bush (valve removing tool)

CAUTION

ARRANGE THE VALVES SO AS TO RECOGNISE THE ORIGINAL POSITION ON THE HEAD (FLY-WHEEL SIDE AND TRANSMISSION SIDE).

- Remove the oil guards using the special tool.

Specific tooling

020431Y Valve oil seal extractor

- Remove the spring supports.

N.B.

BLOW THE SEATS WITH COMPRESSED AIR TO FACILITATE THE SPRING SUPPORT REMOVAL.

Removing the cylinder - piston assy.

- Remove the timing chain.
- Loosen the fastening screw and remove the spacer and the tightening sliding block.

N.B.

IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.

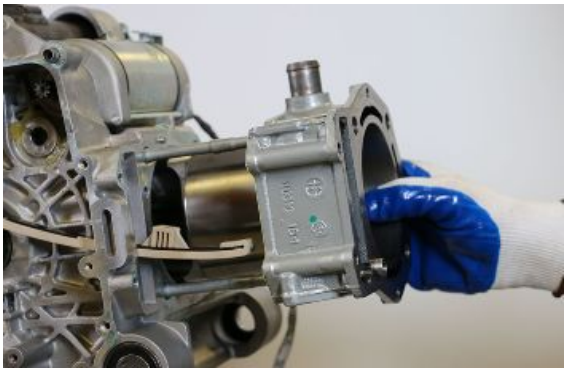
- Extract the cylinder with the relevant gasket and the centring dowel.

N.B.

THE SECOND CENTRING IS ENSURED BY A PIN SET INTO THE CYLINDER.

CAUTION

TO PREVENT DAMAGING THE PISTON, SUPPORT IT WHILE REMOVING THE CYLINDER.

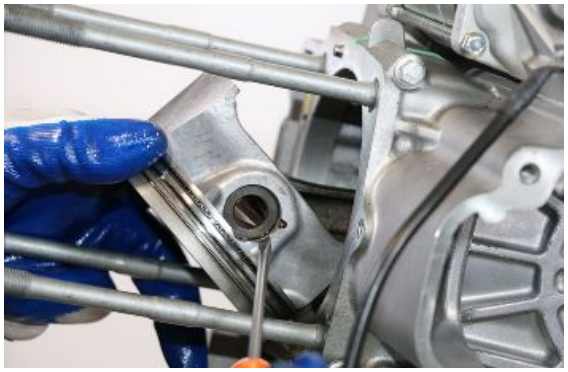


- Remove the 2 piston pin locking rings by the specific housings.

- Extract the pin and remove the piston.

N.B.

USE PAPER OR A CLOTH TO CLOSE THE CYLINDER HOUSING MOUTH ON THE CRANKCASE TO PREVENT SLIPPAGE OF ONE OF THE PIN LOCKING RINGS INTO THE CASE.



- Remove the piston sealing rings and the oil scraper.

CAUTION

NOTE THE ASSEMBLY POSITIONS OF THE LININGS TO PREVENT INVERTING THE POSITION IN CASE OF REUSE.

N.B.

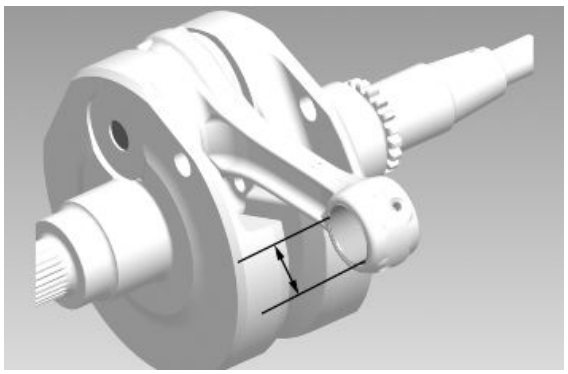
BE CAREFUL NOT TO DAMAGE THE SEALING RINGS DURING REMOVAL.

Inspecting the small end

- Using a bore gauge, measure the connecting rod small end diameter.

N.B.

IF THE CONNECTING ROD SMALL END DIAMETER EXCEEDS THE STANDARD DIAMETER, EXHIBITS WEAR OR OVERHEATING, PROCEED TO REPLACE THE CRANKSHAFT AS DESCRIBED IN THE CRANKCASE AND CRANKSHAFT CHAPTER.



Characteristic

Standard diameter:

22 + 0.025 +0.015 mm

Inspecting the wrist pin

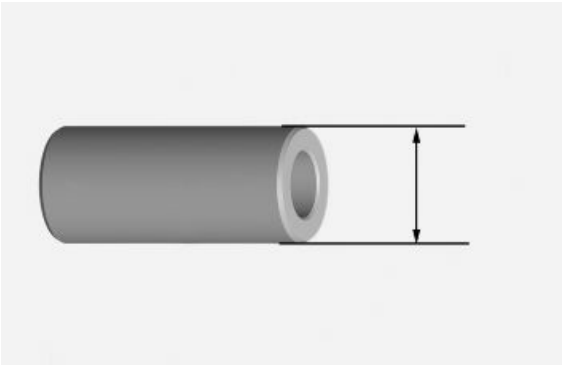
- Check the pin outside diameter using a micrometer.

Characteristic

Standard diameter:

22 0 -0.004 mm

- Calculate the coupling clearance between pin and connecting rod small end.



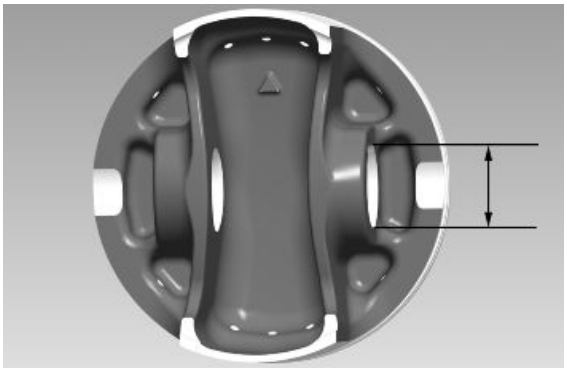
Characteristic

Standard clearance:

0.015 - 0.029 mm

Inspecting the piston

- Measure the diameter of the bearings on the piston.



Characteristic

Standard diameter:

22 + 0.006 + 0.001 mm

- Calculate the piston pin coupling clearance.

N.B.

THE PIN HOUSINGS HAVE 2 LUBRICATION CHANNELS. FOR THIS REASON, MEASUREMENT MUST BE MADE ACCORDING TO THE PISTON AXIS

Characteristic

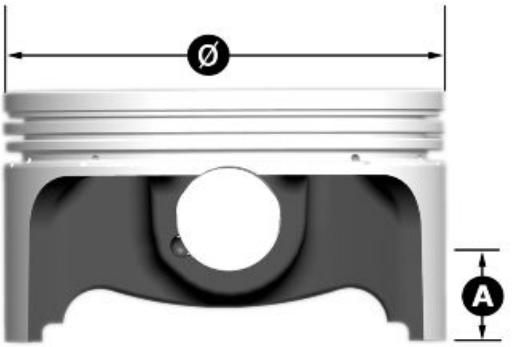
Standard clearance:

0.001 - 0.010 mm

- Measure the outside diameter of the piston, perpendicular to the gudgeon pin axis.
- Take the measurement in the position shown in the figure.

N.B.

REFER TO THE «SPECIFICATIONS» SECTION FOR THE SIZES OF THE PISTON AND THE CYLINDER-PISTON COUPLING CLEARANCES.



Characteristic

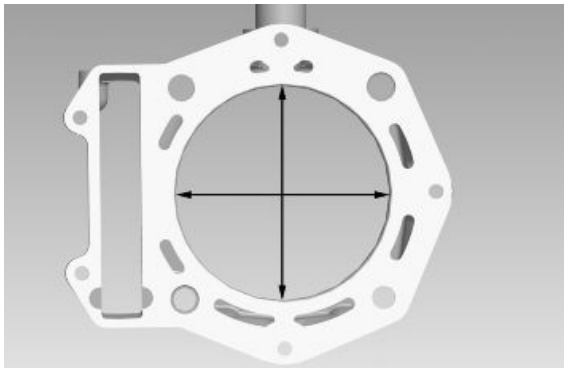
A:

10 mm

Piston diameter:

94 mm nominal value

- Using a bore meter, measure the cylinder inner diameter at a given height according to the directions shown in the figure.



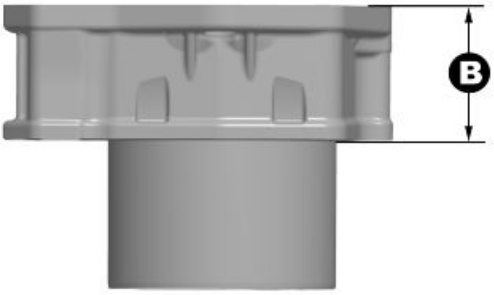
Characteristic

B:

43 mm

Standard diameter:

94 mm nominal value



- Check that coating is free from flakes.
- Check that the head coupling surface is not worn or misshapen.

Characteristic

Maximum allowable run-out:

0.001 in 0.05 mm

- Pistons and cylinders are classified into categories based on their diameter. The coupling is carried out in pairs (A-A, B-B, C-C, D-D).

N.B.

REFER TO THE «SPECIFICATIONS» SECTION FOR THE SIZES OF THE CYLINDER AND THE CYLINDER-PISTON COUPLING CLEARANCES.

Inspecting the piston rings

- Alternately insert the three sealing rings into the cylinder, in the area where it retains its original diameter. Using the piston, insert the rings perpendicularly to the cylinder axis.
- Make sure that each single sealing ring evenly adheres to the cylinder liner. If it does not, this means the ring is worn. Replace it.
- Measure the opening (see figure) of the sealing rings using a feeler gauge.

- If higher values than those prescribed are measured, replace the linings.

SEALING RINGS TOLERANCE

Measurements made with rings fitted

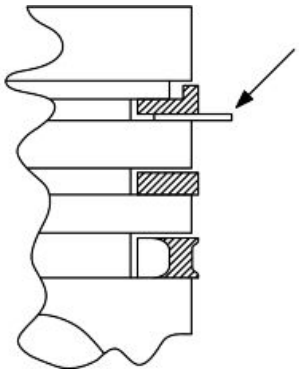
	Dimensions
First compression ring	0,150 ÷ 0,350 mm
Second compression ring	0,250 ÷ 0,500 mm
Oil scraper ring	0,250 ÷ 0,500 mm

Rings/slots coupling clearances

Carefully clean the sealing rings housings.

Place a feeler gauge between the ring and the housing as shown in the drawing and check the coupling clearances.

If clearances measured exceed the maximum values specified in the table, the piston should be replaced by a new one.



RINGS/SLOTS COUPLING CLEARANCES

	Standard coupling clearance	maximum admissible clearance after use
First compression ring	0,01 ÷ 0,06 mm	0.10 mm
Second compression ring	0,02 ÷ 0,07 mm	0.10 mm
Oil scraper ring	0,01 ÷ 0,06 mm	0.10 mm

Removing the piston

- Fit the piston and wrist pin onto the connecting rod, aligning the piston arrow the arrow facing towards the exhaust.

- Insert the locking ring into the special tool, with the opening in the position indicated on the tool.

S = left

D = right

- Place the wrist pin retainer ring into position using a punch.

- Install the pin lock using the key shown in the figure.

Specific tooling

020470Y Tool for fitting the pin locking stops

N.B.

THE TOOL FOR INSTALLING THE RETAINER RINGS MUST BE USED MANUALLY.

CAUTION

USING A HAMMER MIGHT DAMAGE THE STOPS' HOUSING.

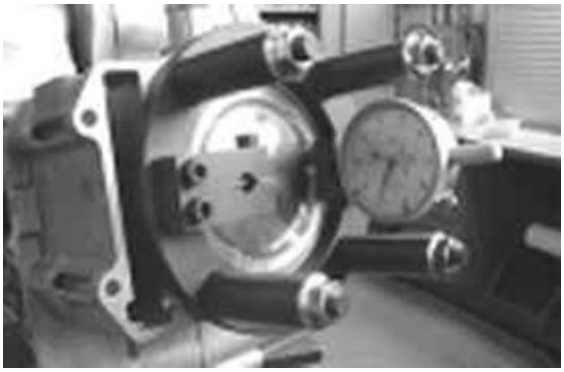
Choosing the gasket

- Provisionally fit the piston into the cylinder, without any base gasket.
- Install a dial gauge on the special tool using the short union, as shown in the figure.

Specific tooling

020475Y Piston position checking tool

- Using an abutment plane, reset the dial gauge with a pre-load of a few millimetres.
- Finally fix the dial gauge.
- Check the perfect sliding of the feeler pin.
- Install the tool on the cylinder without changing the dial gauge position.
- Lock the tool using the original head fixing nuts.



- Rotate the crankshaft up to the TDC (the inversion point of the dial gauge rotation).
- Measure the deviation from the reset value.
- Identify the thickness of the cylinder base gasket to be used for reassembly by the table below. Correctly identify the cylinder base gasket thickness to keep the correct compression ratio.
- Remove the special tool and the cylinder.

N.B.

IF DEVIATIONS (PROTRUSIONS OR RECESSES) CLOSE TO THE CHANGE OF CATEGORY ARE MEASURED, REPEAT THE MEASUREMENT AT THE OPPOSITE SIDE. TO DO SO, REPEAT THE TOOL FITTING OPERATION, INVERTING ITS POSITION.

Characteristic

Recess / Projection measured 1

- 0.185 - - 0.10

Gasket thickness 1

0.4 ± 0.05

Recess / Projection measured 2

- 0.10 - + 0.10

Gasket thickness 2

0.6 ± 0.05

Recess / Projection measured 3

+ 0.10 ÷ + 0.185

Gasket thickness 3

0.8 ± 0.05

Refitting the piston rings

- Place the scraper ring spring on the piston.
- Install the scraper ring keeping the opening opposed to the spring junction and with the writing "top" facing the piston crown. The chamfered side of the oil scraper ring should always be facing the piston crown.
- Fit the second lining with the identification letter or the writing "top" facing the piston crown. In any case, the step must be facing opposite the piston crown.
- Install the first compression ring in the direction imposed by the housing.

- It is advisable to use a fitter to facilitate the installation of the linings.

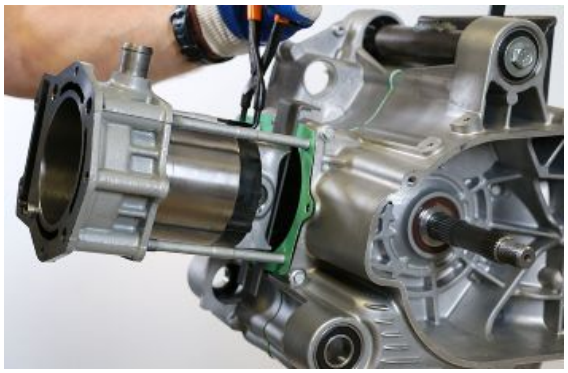
N.B.

THE TWO PISTON RINGS ARE MADE WITH A TAPERED CYLINDRICAL CONTACT CROSS-SECTION. THIS IS TO ACHIEVE A BETTER BEDDING.

- Misalign the lining openings at 120° as shown in the figure.
- Lubricate the components with engine oil.
- The engine uses the first compression lining with an L section.

Refitting the cylinder

- Insert the cylinder base gasket with the thickness determined above.
- Using the fork and the ring clamp, fit the cylinder as shown in the figure.



N.B.

BEFORE FITTING THE CYLINDER, CAREFULLY BLOW THE LUBRICATION DUCT AND LUBRICATE THE CYLINDER LINER. CHECK THE PRESENCE OF THE TWO REFERENCE DOWELS.

Specific tooling

020468Y Piston fitting ring

020512Y Piston fitting fork

Inspecting the cylinder head

- Using a trued bar and a feeler gauge, check that the cylinder head surface is not worn or distorted.

Characteristic

Maximum allowable run-out:

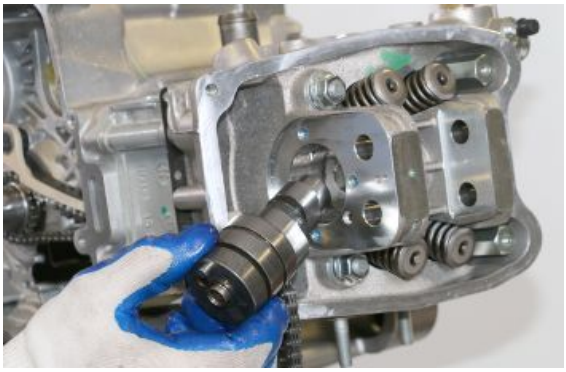
0.1 mm

- In case of faults, replace the head.
- Check the sealing surfaces for the intake and exhaust manifold.
- Check that the camshaft and the rocker pin capacities exhibit no wear.
- Check that the head cover shows no signs of wear.
- Check that the coolant seal plug exhibits no oxidation.

Inspecting the timing system components

- Check that the guide slider and the tensioner slider are not worn out.
- Check that the crankshaft pinion and the camshaft timing gear and crankshaft pinion exhibit no wear.

In case of wear of the sliding blocks, replace them.
In case of wear of the chain or rim, replace the entire unit.



N.B.

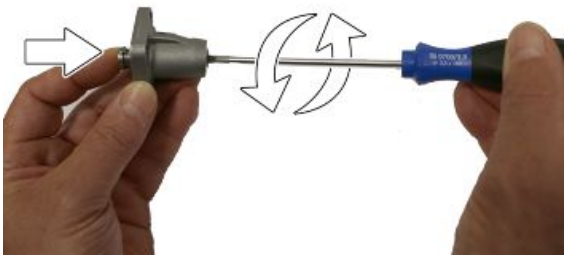
IF THE CHAIN HAS DAMAGED THE PINION, REPLACE THE CRANKSHAFT AS DESCRIBED IN CHAPTER CRANKCASE AND CRANKSHAFT.

Chain tensioner

- Remove the central screw and check the integrity of the gasket.

Chain tensioner

- Make sure that there is no wear on the mechanism and that turning with a slotted screwdriver the chain tensioner can be arm or disarm correctly.
- In case of wear or malfunction, replace the chain tensioner.



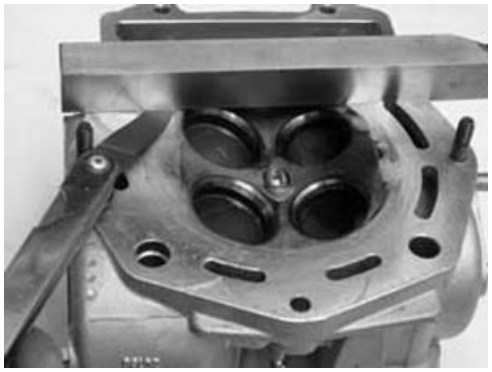
Inspecting the valve sealings

- Visually inspect the valve sealing surface.

CAUTION

DO NOT REVERSE THE FITTING POSITIONS OF THE VALVES (RIGHT - LEFT).

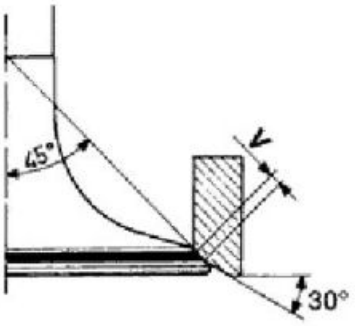
- If the sealing surface of the valve is found to be interrupted at one or more points or is not flat, replace the valve.



- Insert the valves into the cylinder head.
- Alternatively check the intake and exhaust valves.
- The test is carried out by filling the manifold with petrol and checking that the head does not ooze through the valves when these are just pressed with the fingers.

Inspecting the valve housings

- Clean the valve seats of any carbon residues.
- Using the Prussian blue, check the width of the impression on the valve seat "**V**".



Characteristic

Standard value:

1 - 1.3 mm

Limit allowed:

1.6 mm

- If the impression width on the valve seat is larger than the prescribed limits, true the seats with a 45° mill and then grind.
- In case of excessive wear or damage, replace the head.

Inspecting the valves

- Measure the diameter of the valve stems in the three positions indicated in the diagram.

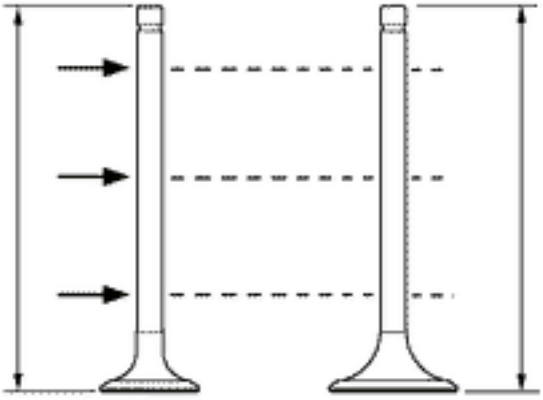
STANDARD DIAMETER

Specification	Desc./Quantity
Intake:	4.987 - 4.972 mm
Exhaust:	4.975 - 4.960 mm

MINIMUM DIAMETER PERMITTED

Specification	Desc./Quantity
Intake:	4.96 mm
Exhaust:	4.945 mm

- Calculate the clearance between the valve and the valve guide.

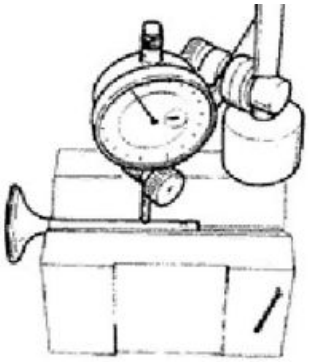


- Check the deviation of the valve stem by resting it on a «**V**» shaped abutment and measuring the extent of the deformation with a dial gauge.

Characteristic

Limit value admitted:

0.1 mm

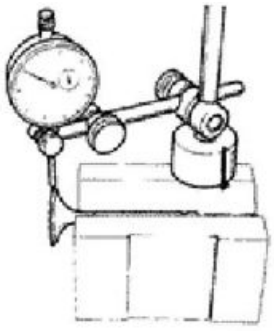


- Check the concentricity of the valve head by placing a dial gauge at right angles to the valve head and rotating it on the «**V**» shaped support.

Characteristic

Limit allowed:

0.03 mm



Inspecting the valve stem guide clearance

- After measuring the valve guide diameter and the valve stem diameter, check clearance between guide and stem.

INTAKE

Specification	Desc./Quantity
Standard clearance:	0.013 - 0.04 mm
Limit allowed:	0.08 mm

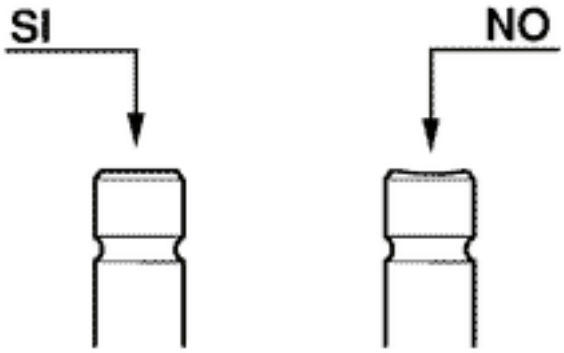
EXHAUST

Specification	Desc./Quantity
Standard clearance:	0.025 - 0.052 mm
Limit allowed:	0.09 mm

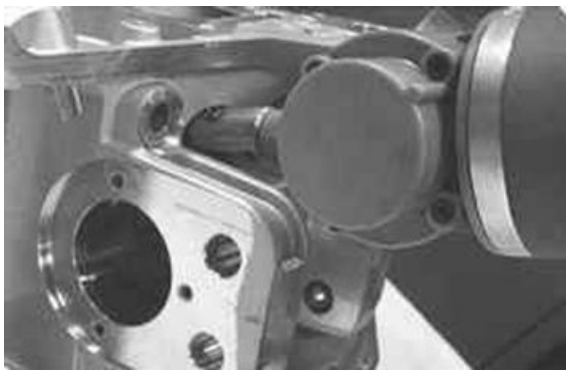
STANDARD VALVE LENGTH

Specification	Desc./Quantity
Intake:	95.0 ± 0.3 mm
Exhaust:	94.2 ± 0.3 mm

- Check that there are no signs of wear on the mating surface with the set screw articulated terminal.



- If no anomalies are found during the above checks, you can use the same valves. To obtain better sealing performance, grind the valve seats. Grind the valves gently with a fine-grained lapping compound. During the grinding, keep the cylinder head with the valve axes in a horizontal position. This will prevent the lapping compound residues from penetrating between the valve stem and the guide (see figure).



CAUTION

TO AVOID SCORING THE MATING SURFACE, DO NOT ROTATE THE VALVE WHEN NO LAPPING COMPOUND IS LEFT. CAREFULLY WASH THE CYLINDER HEAD AND THE VALVES WITH A SUITABLE PRODUCT FOR THE TYPE OF LAPPING COMPOUND BEING USED.

CAUTION

DO NOT REVERSE THE FITTING POSITIONS OF THE VALVES (RIGHT - LEFT).

Inspecting the springs and half-cones

- Check that the upper and lower supporting spring washers, the cotters and the oil seal show exhibit no signs of abnormal wear. Replace a component when worn.

- Measure the unloaded spring length.

Characteristic

Standard length:

44.4 mm

Limit allowed after use:

42.4 mm

Refitting the valves

- Place the valve spring support washers on the head.
- Alternately insert the 4 oil guards using the special tool.
- Lubricate the oil guards and the valve guides.

Specific tooling

020306Y Punch valve seal rings fitting

- Fit the valves, the springs and the caps. Using the appropriate tool with adapter, compress the springs and insert the cotters in their seats.

Specific tooling

020382Y Valve cotters equipped with part 012 removal tool

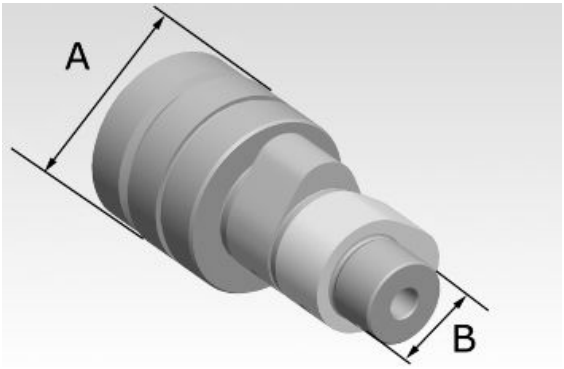
020382Y012 bush (valve removing tool)

N.B.

DO NOT CHANGE THE VALVE FITTING POSITION. FIT THE VALVE SPRINGS WITH THE REFERENCE COLOUR ON COTTER SIDE (TURNS WITH GREATER PITCH).

Inspecting the cam shaft

- Check that the camshaft bearings exhibit no scores or abnormal wear.
- Using a micrometer, measure the camshaft bearings.



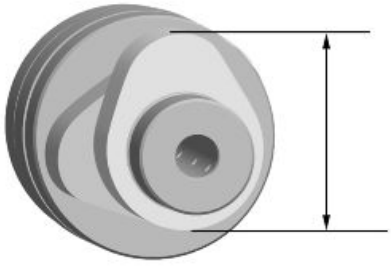
STANDARD DIAMETER

Specification	Desc./Quantity
Bearing A Ø:	42- 0.060 -0.085 mm
Bearing B diameter:	20- 0.020 -0.041 mm

MINIMUM DIAMETER PERMITTED

Specification	Desc./Quantity
Bearing A Ø:	41.910 mm
Bearing B diameter:	19.940 mm

-Using a gauge, measure the cam height.



STANDARD HEIGHT

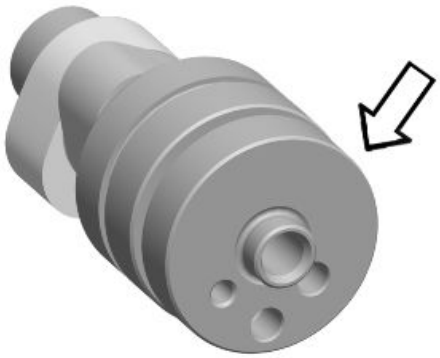
Specification	Desc./Quantity
intake	33.774 mm

Specification	Desc./Quantity
exhaust	33,273

LIMITS ALLOWED

Specification	Desc./Quantity
intake	33.526 mm
exhaust	33.026 mm
Standard axial clearance:	0 - 0.22 mm
Maximum admissible axial clearance:	0.3 mm

- If any of the above dimensions are outside the specified limits, or there are signs of excessive wear, replace the defective components with new ones.
- Check that the retaining plate seat shown in the figure exhibits no wear.



- Check that there is no wear at the automatic valve lifter cam and at the end stop roller.
- Check that the valve lifter spring has not yielded.
- Replace any defective or worn components.

- Check that the rocker pins exhibit no scores or wear.

Characteristic

Standard diameter:

Ø 13 - 0.010 -0.018 mm

- Measure the inside diameter of each rocker.

Characteristic

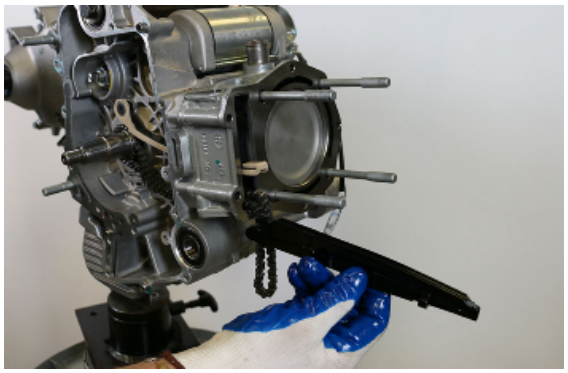
Standard diameter:

Ø 13 + 0.026 +0.015 mm

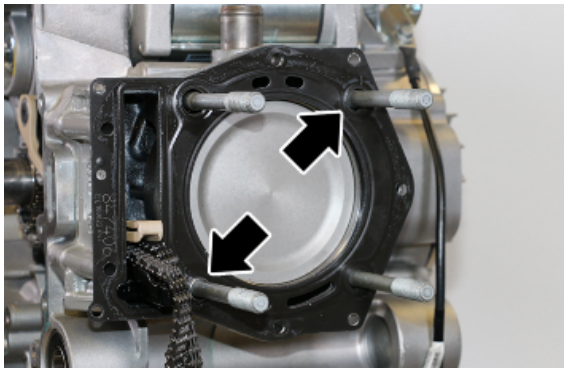
- Check that the cam contact sliding block and the articulated register cap is free from wear.
- In case of wear, replace the component.

Refitting the head and timing system components

- Insert the chain guide sliding block.
- Insert the two centring dowels between head and cylinder.
- Install the head gasket.



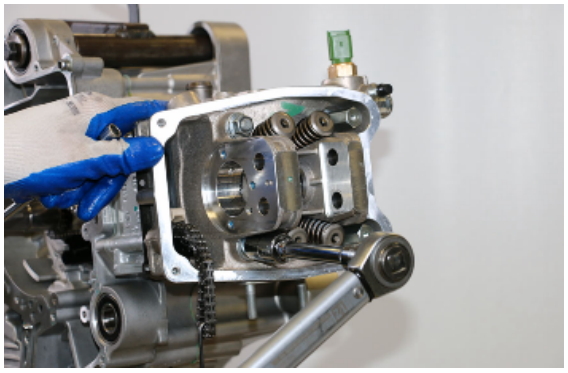
- The head gasket is made of steel and has a standard thickness.



N.B.

THE FIGURE SHOWS THE INSERTION POSITION OF THE TWO CENTRING DOWELS BETWEEN HEAD AND CYLINDER. THE DIRECTION OF INSTALLATION FOR THE GASKET IS FORCED BY THE DOWELS.

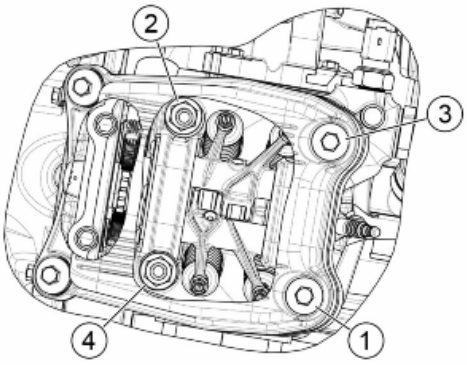
- Check that the head lubrication channel is perfectly clean. Clean with compressed air jets, if required.
- Insert the head.
- Lubricate the stud bolts and the 4 fixing stud bolts.



- Tighten the 4 fixing stud bolts crosswise to the prescribed torque as shown in the figure.

Locking torques (N*m)

Head fixing stud bolts **10 Nm + 90° + 90° (5.2 lb*ft + 90° + 90°)**



*** Apply a preliminary torque of 7 Nm in a crossed sequence.

- Tighten by 90° in a crossed sequence.
- tighten again by 90° in a crossed sequence.

- Tighten the fastening nuts on the exhaust and on the intake side to the prescribed torque.

Locking torques (N*m)

Exhaust/intake head fastening nuts 10 - 12

- Tighten the 3 side screws to the prescribed torque.

Locking torques (N*m)

Cylinder head fastening screws 10 - 12

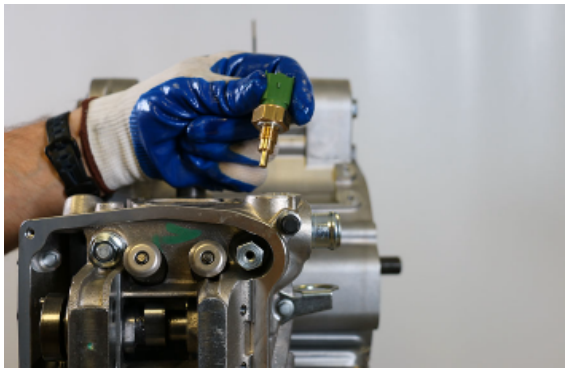
- Using a 22 mm wrench, install the coolant temperature sensor with relative washer and tighten to the prescribed torque.

CAUTION

FAILURE TO OBSERVE THE TIGHTENING TORQUE CAN DAMAGE THE SENSOR.

Locking torques (N*m)

Coolant temperature sensor 10 - 12



- Fit the spark plugs and tighten them to the prescribed torque.

Locking torques (N*m)

Spark plug 12 - 14

- Insert the timing control belt on the crankshaft according to the initial direction of rotation.
- Install the tensioner shoe with its spacer, tightening the bolt to the prescribed torque, using the recommended product.

Recommended products

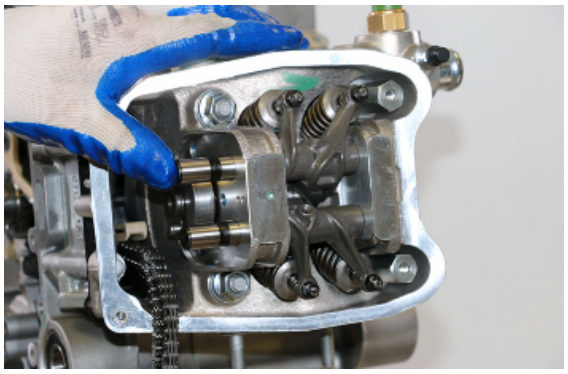
Loctite 243 Medium strength thread-locking sealant.

Blue

Locking torques (N*m)

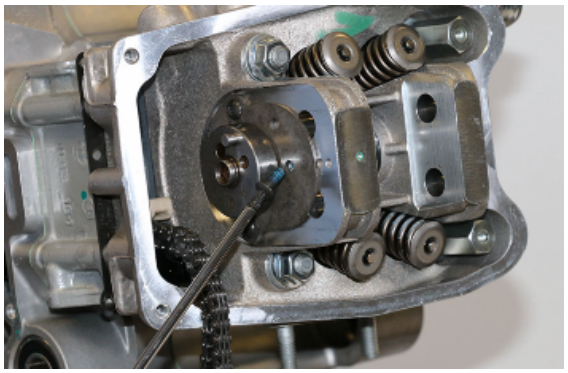
Tensioner pad fixing screw **10 - 14**

- Insert pins and rocking levers on the flywheel side.
- Lubricate the two rocking levers through the holes at the top.



- Clean the camshaft by blowing with little compressed air jets, especially the retaining plate housing.
- Lubricate the 2 shafts.
- Insert the camshaft into the head with the cams opposite the rocking levers.

- Remove any LOCTITE residues from the screws fixing the camshaft retaining bracket using a brush.
- Apply the recommended product to the fixing screws and tighten to the prescribed torque.



Recommended products

Loctite 243 Medium strength thread-locking sealant.

Blue

- Insert the camshaft retain bracket with visible countersinks and tighten the 3 fastening screws to the prescribed torque, being careful not to damage the inside hexagon.

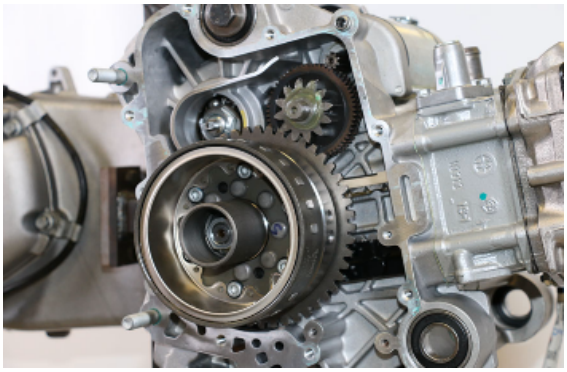
Locking torques (N*m)

Camshaft retaining bracket screws **4 - 6**

- Install the intermediate gear with torque limiter, the flywheel and its cover, as described in Chapter "Flywheel and start-up system", and in Chapter "Flywheel cover".

N.B.

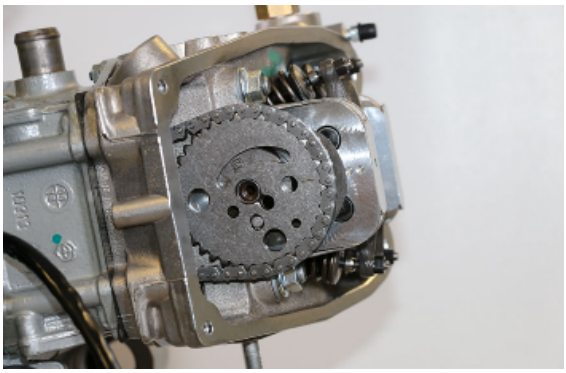
FOR MORE CONVENIENCE, INSTALL THE FLYWHEEL COVER WITHOUT THE COOLING SYSTEM SLEEVES.



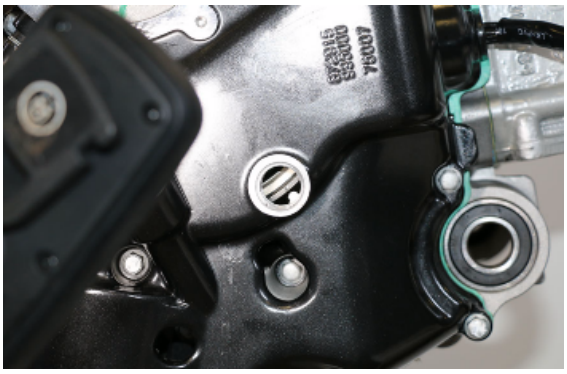
- Insert the belt on the camshaft control timing rim.
- Insert the timing rim on the camshaft checking that the references are aligned.

N.B.

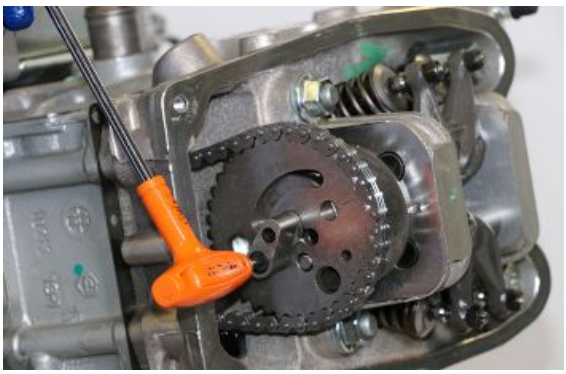
DURING THE STROKE CHECK, KEEP THE BELT TENSIONED BY PRESSING ON THE TIGHTENER COMPARTMENT SIDE.



- Using a TORX type wrench, remove the timing check cap.
- Keeping the belt slightly pulled, turn the crankshaft using the driving pulley to make the reference on the magnet support collimate with that on the flywheel cover.



- Install the counterweight mass.
- Centre using the bell fastening screw.
- Lock the mass fixing screws to the prescribed torque, using the recommended product.



Recommended products

Loctite 243 Medium strength thread-locking sealant.

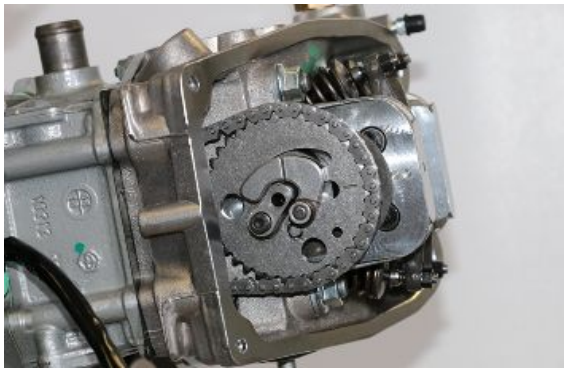
Blue

Locking torques (N*m)

Counterweight screw 7 to 8.5

- Remove the central screw.
- Install the valve lifting mass being careful to the proper positioning of the travel end ring.
- Lubricate the mass and de-compressor control pin.

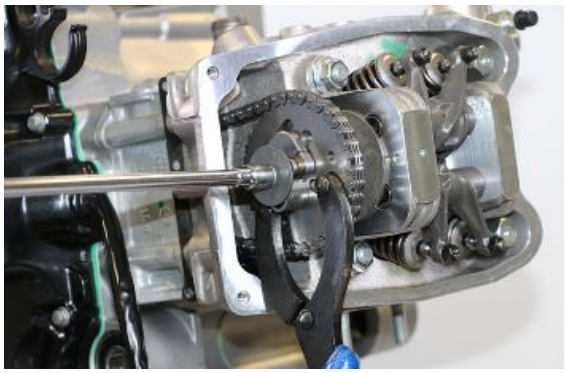
- Install the return spring and load it by about 3/4 turn.



- Turn the engine to move the references to the top as shown in the figure (intake end).
- Insert the valve lifting device mass stop bell.
- Tighten the retaining screw to the prescribed torque, using the recommended product.
- Check that the decompression mass is free and that it is pulled by the spring.

N.B.

THE BELL TIMING IS ENSURED BY THE COUNTER-WEIGHT MASS FASTENING SCREW HEAD.



Specific tooling

020565Y Flywheel lock calliper spanner

Recommended products

Loctite 243 Medium strength thread-locking sealant.

Blue

Locking torques (N*m)

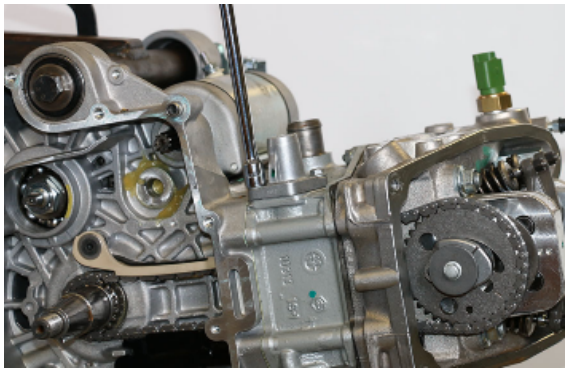
Valve lifter weight stop bell fastening screws
30 - 35 Nm (22 -26 lb*ft)

- Place the tightener cursor in the rest position, keeping the retain tab pressed.

- Install a new tightener on the cylinder using a new gasket.
- Tighten the two fastening screws to the prescribed torque.

Locking torques (N*m)

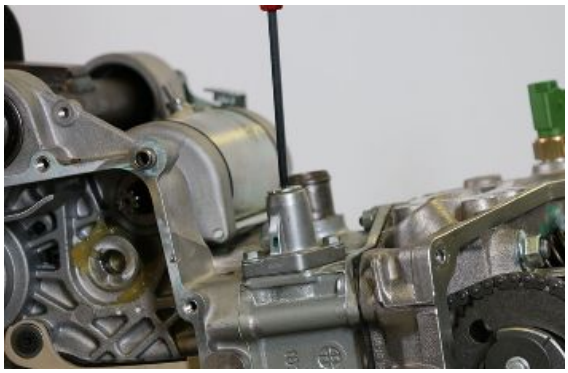
Tensioner fastening screws **11 to 13**



- Insert the spring with the central screw and the washer.
- Tighten the central screw to the prescribed torque.

Locking torques (N*m)

Tensioner screw **5 to 6**



- Place the engine with the valve clearance adjustment timing references aligned with the head.
- Check the clearance between valve and rocking lever using a thickness gauge.

PRESCRIBED CLEARANCE

Specification	Desc./Quantity
Intake	0.10 mm (engine cold)
Exhaust	0.15 mm (engine cold)

- In case different values are found, adjust by loosening the lock nut and use a screwdriver for the set screw as shown in the figure.

Refitting the timing chain

The ignition advance is determined electronically on the basis of parameters known by the control unit.
For this reason it is not possible to interpret the reference values based on the engine rpm.
The ignition advance value is detectable at any time using the diagnostic tester.
It is possible to check whether the ignition advance determined by the injection system matches the value actually activated on the engine, by means of the stroboscopic light.

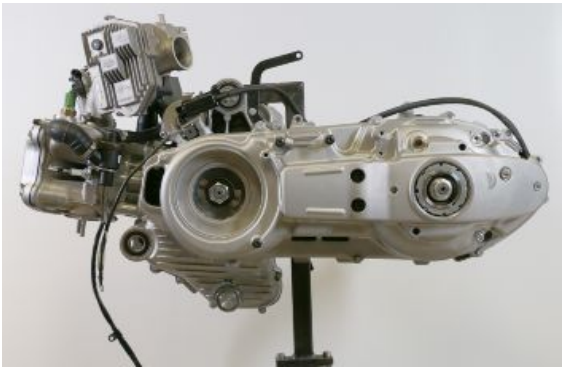
Specific tooling

020922Y Diagnosis Tool

020330Y Stroboscopic light to check timing

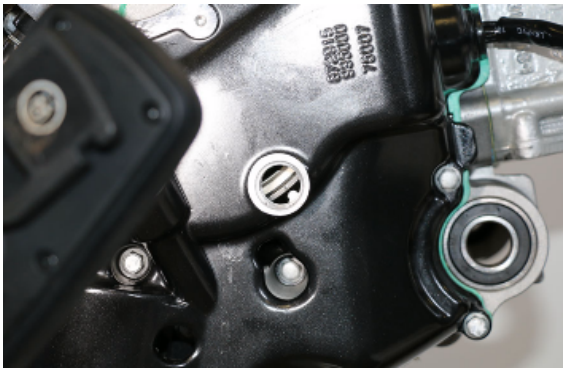
Proceed as follows:

- Remove the outside transmission cover as described in the automatic transmission chapter.



- Remove the TDC reference inspection cap between flywheel and crankcase cover. See the flywheel cover chapter.

- By the driving pulley, turn the engine to find the alignment of the references to identify the TDC.



- Repeat for the reference between driving pulley and transmission housing.

- Refit the inspection cap on the flywheel side.
- Connect the diagnostic tester.
- Start the engine.
- Select the «parameters» function in this menu.
- Select the stroboscopic light control in the traditional four-stroke engine position (1 spark, 2 revs).
- Check that the real values of rpm and ignition advance match those measured using the diagnostic tester.

Specific tooling

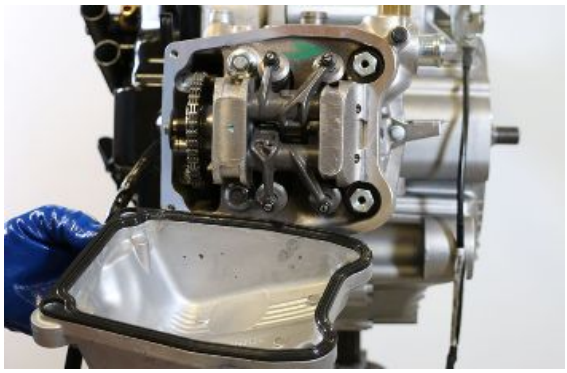
020922Y Diagnosis Tool

If the values do not match, check:

- distribution timing
- revolution timing sensor
- injection control unit

Refitting the rocker-arms cover

- Check that the gasket is in good condition.



- Tighten the tappet cover to the specified torque.

Locking torques (N*m)

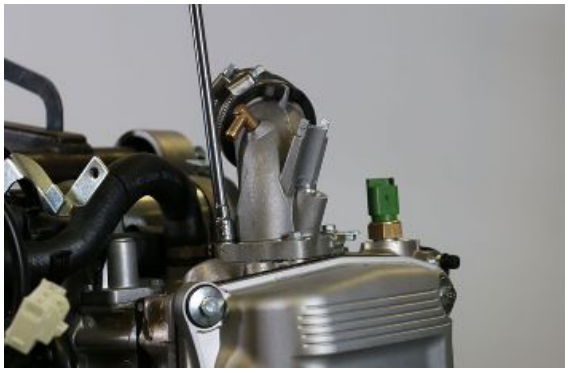
Tappet cover fastening screws 7 - 9 Nm (5.2 -6.6 lb*ft)

Refitting the intake manifold

- Install the intake manifold on the engine.
- Insert the 3 fastening screws, one of which with a support band for the cooling system sleeve, and tighten to the prescribed torque.

Locking torques (N*m)

Intake manifold screws 11 - 13



Crankcase - crankshaft

- Remove the outside and inside transmission cover and the complete driving pulley as described in "Automatic transmission".

- Remove the flywheel cover with the cooling system sleeves, as described in the "Flywheel cover" chapter.

- Remove the flywheel with the starting system following the instruction given in "Flywheel and Starting system".

- Remove the thermal group (cylinder, head, piston) as described in the «Thermal group and timing system chapter».

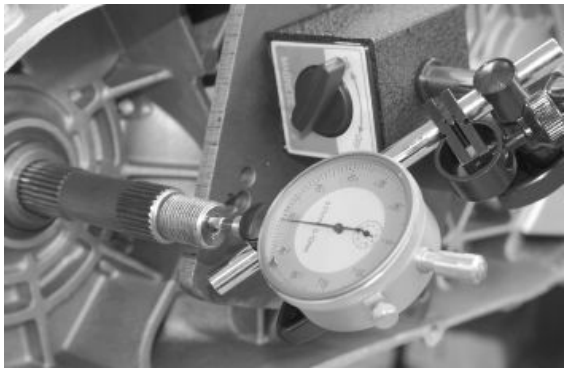
- Before opening the crankcase, check the crankshaft axial clearance.

For this purpose, use a plate (e.g. the special tool) and a support with special tool comparator.

Specific tooling

020262Y Crankcase splitting plate

020335Y Magnetic mounting for dial gauge



Characteristic

Standard clearance:

0.10 - 0.50 mm

Admissible increase limit after use:

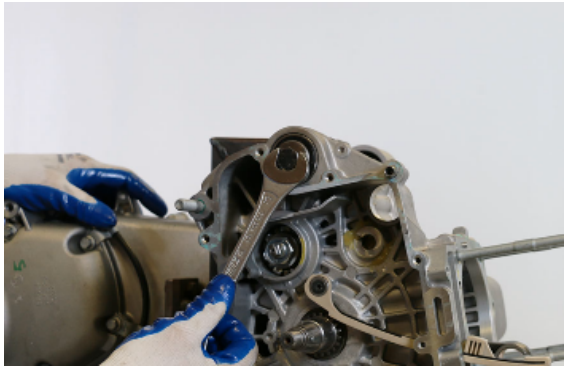
0.60 mm

- Upper clearances are an indication of wear on the surfaces of the crankshaft casing support.

- To carry out an accurate measurement, measure the clearance in both directions between crankcase and crankshaft.

Splitting the crankcase halves

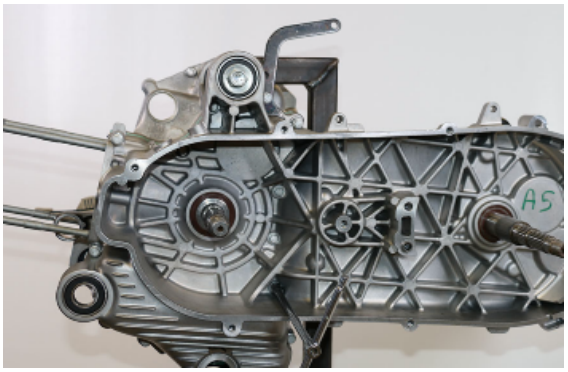
- Remove the engine support retain screw on the flywheel side half-crankcase.



- Remove the 14 crankcase coupling screws.

N.B.

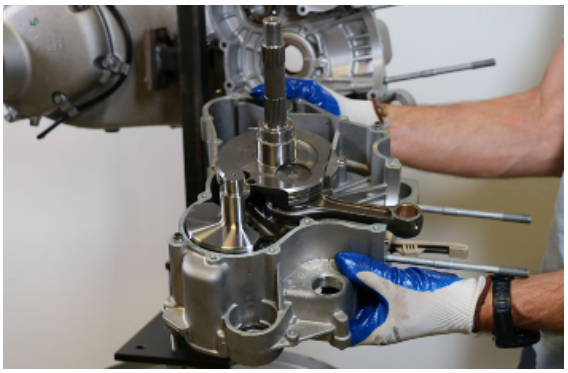
THE FASTENING SCREWS ARE OF 3 DIFFERENT LENGTHS. NOTE THEIR CORRECT POSITION.



- Split the crankcases while keeping the crankshaft inserted on the flywheel side half-crankcase.
- Remove the coupling gasket.

N.B.

THE BUSHING SUPPORT CAN BE LEFT IN THE FLY-WHEEL SIDE HALF-CRANKCASE.



Removing the crankshaft

- Before removing the crankshaft, check the timing with the countershaft. To carry out this check, turn the crankshaft to align the two holes obtained on the crankshaft with the hole on the countershaft control gear.
This is an optimal position also to remove the crankshaft.

- Remove the crankshaft with the shim adjustment washer on the flywheel side.

CAUTION

WHILE OPENING THE CRANKCASE AND REMOVING THE CRANKSHAFT, CHECK THAT THE SHAFT THREADED ENDS DO NOT INTERFERE WITH THE MAIN BEARINGS. FAILURE TO OBSERVE THIS PRECAUTION CAN DAMAGE THE MAIN BEARING.

Removing the oil pump and countershaft control gear.

- To remove the control gear, loosen the 4 fastening screws.

Remove the gear only if actually required.

CAUTION

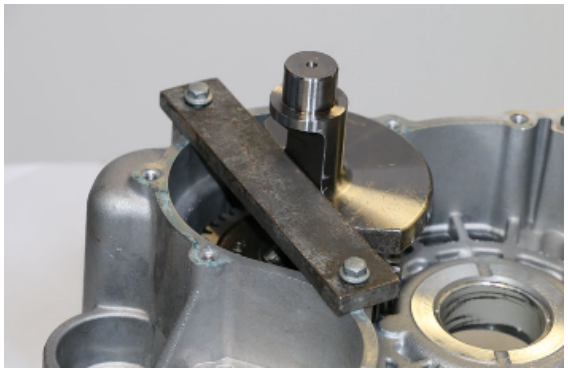
THE SCREWS HAVE A COUNTERSUNK HEAD AND THEIR THREADING IS LOCKED BY LOCTITE. BE CAREFUL NOT TO DAMAGE THE CONTROL HEXAGON. TO OBTAIN BETTER RESULTS IT IS PREFERABLE TO USE AN INSIDE HEXAGON SOCKET WRENCH.

Removing the countershaft

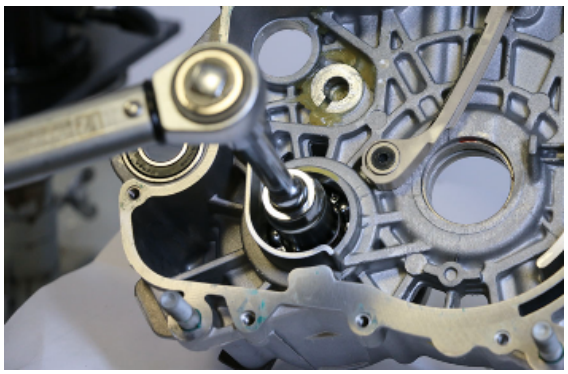
- Place the special tool as shown in the figure.

Specific tooling

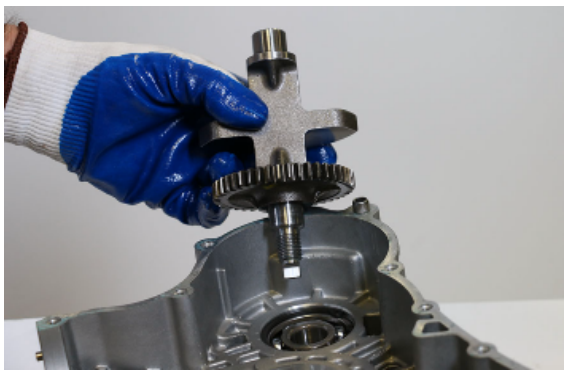
020479Y Countershaft lock wrench



- Remove the fastening nut with relevant washer.



- Remove the special tool and extract the countershaft with the control gear.



Replacing the countershaft bearings

- Check that the bearings are free from irregular noise or clearance. If it does, replace it.

Flywheel-side half-crankcase

- Remove the inside Seeger ring.

- Upturn the half-crankcase.
- Remove the bearing from the flywheel side half-crankcase using the special tool and a mallet.

Specific tooling

020376Y Adaptor handle

020358Y 37 x 40 mm Adaptor

020439Y 17-mm guide

- Remove the bearing from the transmission side half-crankcase using the special tool.

Specific tooling

001467Y008 Clamp to extract 17 mm ø bearings

001467Y007 Driver for OD 54-mm bearings

- Before installing a new bearing, heat the flywheel side half-crankcase using the special tool.
- Place the half-crankcase on a wooden base.

Specific tooling

020151Y Air heater

- Insert a new bearing on the special tool after greasing the guide seat.
- Install the new bearing on the half-crankcase using the special tool.

N.B.

IF A BEARING WITH PLASTIC CAGE IS USED, KEEP THE BALLS VISIBLE FROM THE CRANKCASE INTERNAL SIDE.

Specific tooling

020376Y Adaptor handle

020359S 42 x 47 mm Adaptor

020439Y 17-mm guide

- Fit the Seeger ring.

- Before installing the new bearing on the transmission side crankcase, heat the seat using the special tool.

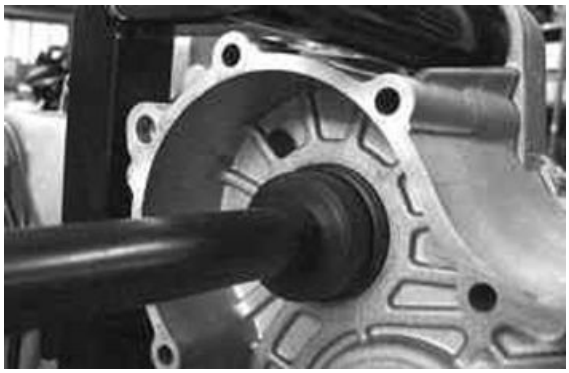
Specific tooling

020151Y Air heater

- Insert a new bearing on the special tool after greasing the guide seat.
- Install the new bearing on the engine crankcase using the special tool.

N.B.

IF A BEARING WITH PLASTIC CAGE IS USED, KEEP THE BALLS VISIBLE FROM THE CRANKCASE INTERNAL SIDE.



Specific tooling

020376Y Adaptor handle

020359S 42 x 47 mm Adaptor

020439Y 17-mm guide

Inspecting the crankshaft components

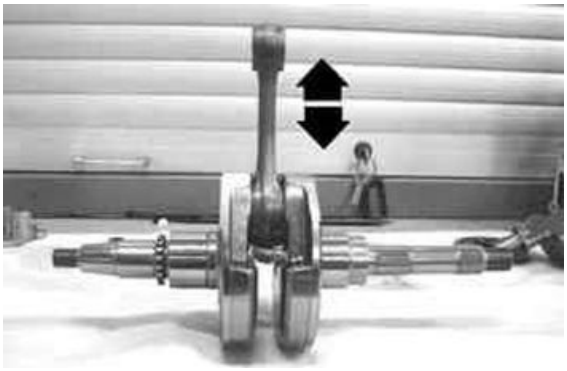
- Check the axial clearance on the connecting rod.

Characteristic

Standard clearance:

0.20 ÷ 0.40 mm

- Check the connecting rod diametrical clearance.

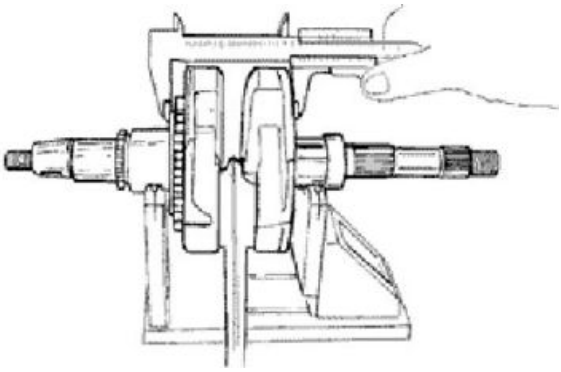


Characteristic

Standard clearance:

0.046 ÷ 0.076 mm

-Check the surfaces that limit the axial free-play are not scored and measure the width of the crankshaft between these surfaces, as shown in the diagram.



N.B.

BE CAREFUL NOT TO LET THE MEASUREMENT BE AFFECTED BY THE UNIONS WITH THE CRANKSHAFT ENDS.

Characteristic

Standard dimensions:

63.6 - 63.45 mm

CAUTION

THE CRANKSHAFT CAN BE REUSED WHEN THE WIDTH FALLS WITHIN THE STANDARD VALUES AND THE SURFACES ARE FREE FROM SCRATCHES.

Shimming

- Check the overall height of the crankshaft - shoulders - gear assembly.

Characteristic

Standard thickness:

71.804 - 72.000 mm

- Check that shim adjustment is free from scratches.

N.B.

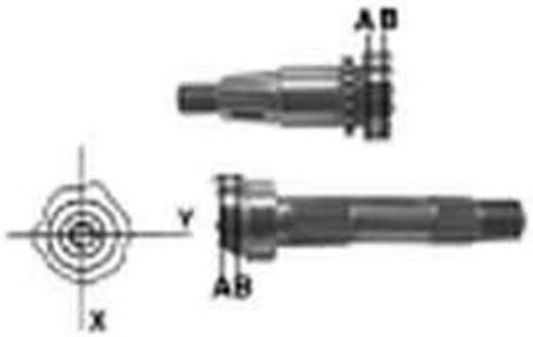
IN CASE OF NEW UTILISATION, MAINTAIN THE FIRST FITTING POSITION.

Specific tooling

020074Y Support base for checking crankshaft alignment

- If the crankshaft - crankcase axial clearance is higher than the standard value and the crankshaft exhibits no irregularity, the problem is caused by wear or by a wrong machining on the engine crankcase.

- Check the diameters of both bearings of the crankshaft in accordance with the axes and surfaces shown in the figure. Half shafts are classified into two categories, Cat 1 and Cat. 2. Refer to the chart below.



STANDARD DIAMETER

Specification	Desc./Quantity
Cat. 1	40.010 ÷ 40.016
Cat. 2	40.016 ÷ 40.022

Inspecting the crankshaft alignment

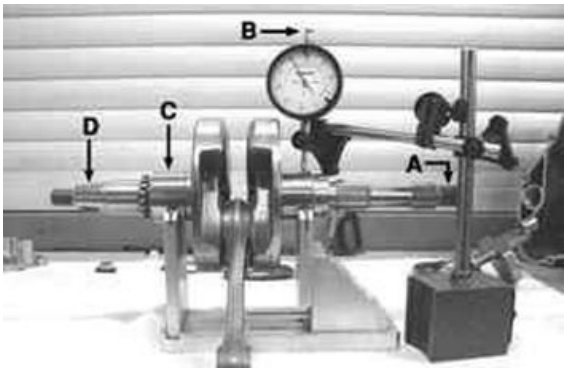
- Install the crankshaft on the support and measure the displacement at the 4 points shown in the figure.

Specific tooling

020074Y Support base for checking crankshaft alignment

MAX ADMISSIBLE DISPLACEMENT:

Specification	Desc./Quantity
A	= 0.15 mm
B	= 0.01 mm
C	= 0.01 mm
D	= 0.10 mm



- Check that the driving shaft cone, the tab seat, the oil seal capacity, the toothed gear and the threaded tangs are in good working order.
- In case of failures, replace the crankshaft.

N.B.

MAIN BEARINGS CANNOT BE MODIFIED.

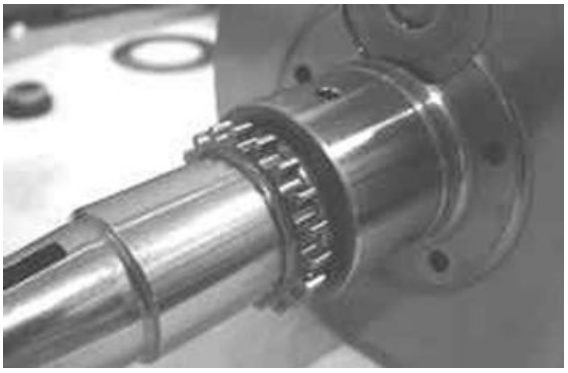
The connecting rod cannot be replaced. To check the connecting rod small end diameter, see chapter "Thermal group and timing system".

- When cleaning the crankshaft, be careful to prevent any impurity from entering into the shaft lubrication hole.

N.B.

IN CASE OF REPLACEMENT OF A CRANKSHAFT CONSISTING OF TWO HALF-SHAFTS OF DIFFERENT CATEGORY, REPLACE THE TWO HALF-CRANKCASES AS WELL, COUPLING THE TWO COMPONENTS (SHAFT AND CRANKCASE) WITH THE SAME CATEGORY.

- To check the gearing of the crankshaft, see section "Thermal group and timing system".

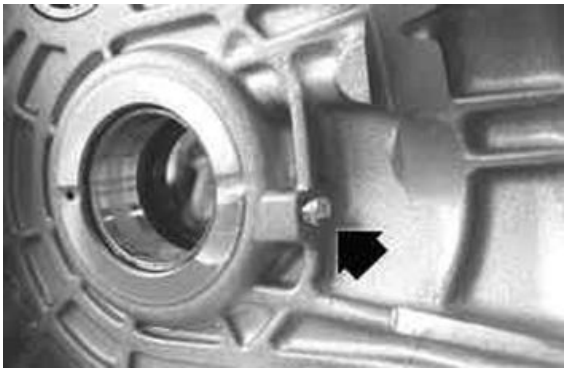


Inspecting the crankcase halves

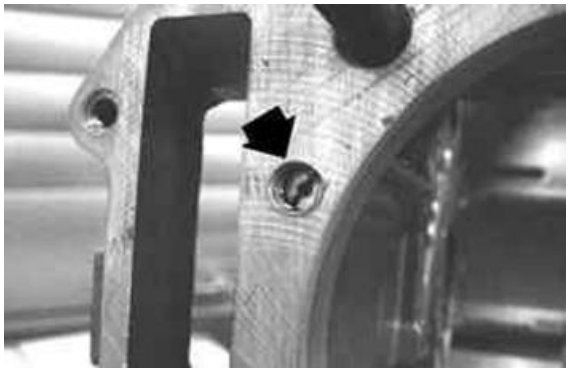
- Before proceeding to check the crankcase halves, thoroughly clean all surfaces and oil ducts.
- For the transmission-side half-crankcase, special attention should be given to the bushings, to the cooling jet on the transmission side (see figure) and to the lubrication duct.

N.B.

THE JET IS FED THROUGH THE MAIN BUSHINGS. PROPER OPERATION OF THIS COMPONENT IMPROVES THE PISTON TOP COOLING. CLOGGING HAS EFFECTS THAT ARE DIFFICULT TO DETECT (PISTON TEMPERATURE INCREASE). FAILURE OR LEAK CAN CONSIDERABLY DECREASE THE MAIN BUSHING AND CONNECTING ROD LUBRICATION PRESSURE.



- For the flywheel side half-crankcase, special attention should be given to the lubrication channels for the main bearings and to the compartment and the channels for the oil pump, as well as to the duct for the by-pass located on the flywheel cover.



N.B.

AS ALREADY DESCRIBED IN THE "LUBRICATION" CHAPTER, IT IS ESPECIALLY IMPORTANT THAT THE BY-PASS HOUSING ON THE FLYWHEEL COVER IS FREE FROM WEAR THAT MAY IMPAIR THE PROPER SEALING OF THE LUBRICATION PRESSURE ADJUSTMENT PISTON. THE HEAD LUBRICATION CHANNEL IS EQUIPPED WITH A SHUTTER JET; THIS GIVES A "LOW PRESSURE" HEAD LUBRICATION. THIS CHOICE WAS MADE TO REDUCE THE OIL TEMPERATURE IN THE SUMP.

The jet clogging impairs the head lubrication and the timing mechanisms.

A jet failure causes a decrease in the main bearing and connecting rod lubrication pressure.

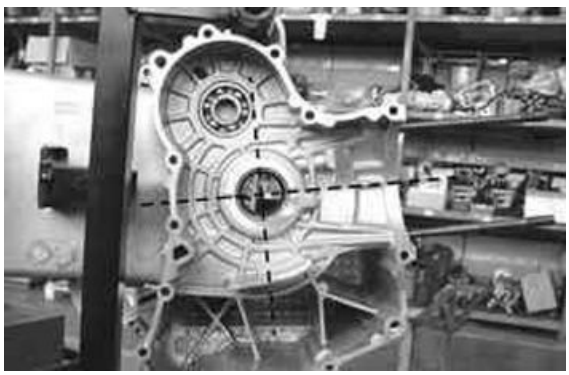
- Check that the surfaces exhibit no dents or deformations, with special attention to the crankcase coupling and the crankcase-cylinder surfaces.

- Any defects in the crankcase gasket or matching surfaces (see Flywheel cover coupling) can cause pressurised oil leaks, thereby affecting the connecting rod and main bearing lubrication pressure.

- Check the main bearing seats that limit axial clearance in the crankshaft exhibit no wear. For the dimensional check, refer to the instructions about checking the axial clearance and the dimensions on the crankshaft

Inspecting the crankshaft plain bearings

- To obtain a good bushing lubrication it is necessary to have both an optimal lubricating pressure (4 bar) and a good oil flow rate; the bushings must be correctly positioned so as not to obstruct the oil supply channels.



- The main bushings are comprised of two half-bearings, one with holes and channels for lubrication whereas the other is solid.

- The solid half-bearing is intended to stand the thrusts caused by combustion, and for this reason it is arranged opposite the cylinder.

- To prevent obstructions in the oil feeding channels, the matching surface of the two half-bearings must be perfectly perpendicular to the cylinder axis, as shown in the figure.

- The oil feeding channel section is also affected by the bushings driving depth compared with the crankshaft axial clearance of the limiting surface.

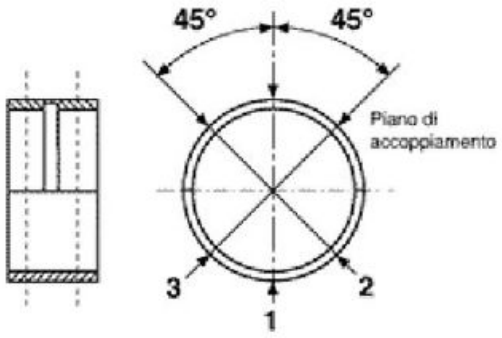
N.B.

TO KEEP THE BUSHINGS ON THE CRANKCASE IN SUCH POSITION, DRIVING IS FORCED ON CAST-IRON RINGS INSERTED IN THE CASTING OF BOTH CRANKCASE HALVES.

- Check the inside diameter of the main bushings in the three directions indicated in the diagram.
- Repeat the measurements for the other bushing half. see diagram.

N.B.

DO NOT TAKE THE MEASUREMENT ON THE TWO HALF-SHELL COUPLING SURFACE SINCE THE ENDS ARE RELIEVED TO ALLOW BENDING DURING THE DRIVING OPERATION.



Before assembling, check that the clearance between the engine crankcase bushing and the crankshaft is within the predetermined limits.

Characteristic

Crankshaft-bushing maximum clearance admitted:

0.08 mm

- The standard bushing diameter after driving is variable on the basis of a coupling selection.
- The crankcase bushing seats are classified into 3 categories while the crankshaft ones, into 2 categories.
- Bushings are subdivided into 4 categories according to their thickness (see the table).

CHECK THE BENCH BUSH

Name	Description	Dimensions	Initials	Quantity
Type A - Red		1.971 ÷ 1.974		
Type B - Blue		1.974 ÷ 1.977		
Type C - Yellow		1.977 ÷ 1.980		
Type D - Green		1.980 ÷ 1.983		

Coupling chart

The following kinds of bushings indicated in the table must be used according to the kind of coupling between the crankshaft and the crankcase.

		X	
		1	2
Y	1	B	A
	2	C	B
	3	D	C

KEY

X = Crankshaft category

Y = Crankcase halves category

A = Red

B = Blue

C = Yellow

D = Green

In case of breakdown, crankcases are together with bushings and are classified according to the centre to centre distance of the countershaft. Find below the possible couplings.

- Complete FC1 type crankcase equipped with bushings for housing a category 1 crankshaft and a countershaft with centre to centre distance A.
- Complete FC2 type crankcase equipped with bushings for housing a category 2 crankshaft and a countershaft with centre to centre distance A.
- Complete FC3 type crankcase equipped with bushings for housing a category 1 crankshaft and a countershaft with centre to centre distance B.
- Complete FC4 type crankcase equipped with bushings for housing a category 2 crankshaft and a countershaft with centre to centre distance B.

N.B.

THE CRANKSHAFT CATEGORY IS STAMPED ON THE COUNTERWEIGHT SHOULDER.

A spare crankcase cannot be combined with a driving shaft with mixed categories. Spare shafts have half-shafts of the same category.

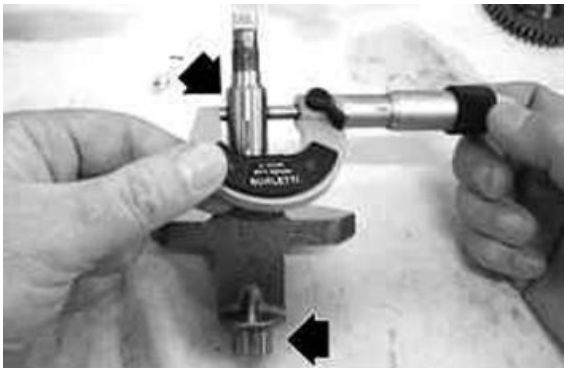
N.B.

TO REPLACE THE HALF-SHAFTS, REMOVE THE COUNTERSHAFT BEARINGS AS DESCRIBED ABOVE. REMOVE THE COMPLETE DRIVEN PULLEY AND THE ANTI-FLAPPING ROLLER FROM

THE TRANSMISSION SIDE HALF-CRANKCASE, AS DESCRIBED IN CHAPTER "AUTOMATIC TRANSMISSION", AND THE HUB COVER WITH THE RELEVANT GEARS AND BEARINGS AS DESCRIBED IN CHAPTER "FINAL REDUCTION".

Countershaft

- Using a micrometer, measure the 2 bearings of the countershaft as shown in the figure.



Characteristic

Standard diameter:

17 - 0.01 - 0.02 mm

- Check that the water pump drive is not worn.

Refitting the crankshaft

- Check that the oil pump and countershaft control gear are free from deformations or dents. Replace, if required.

N.B.

IF YOU HAVE TO REPLACE THE OIL PUMP AND COUNTERSHAFT CONTROL GEAR IT IS NECESSARY TO REPLACE THE COUNTERSHAFT GEAR AS WELL.

- Before installing the gear on the crankshaft, carefully clean the two matching surfaces removing any residues of LOCTITE from the holes using a brush.

Blow with compressed air and degrease the mounting holes on both surfaces to make the new LOCTITE grip.

Apply the recommended product to the holes again.

Recommended products

Loctite 243 Medium strength thread-locking sealant.

Blue

- Repeat the same procedure for the 4 fastening screws.
- Insert the control gear on the crankshaft with the hole countersink visible.
- Tighten the 4 fastening screws to the prescribed torque.

N.B.

TO AVOID DAMAGING THE SCREW CONTROL HEXAGON, IT IS PREFERABLE TO USE AN INSIDE HEXAGON SOCKET WRENCH.

Locking torques (N*m)

Crankshaft gearwheel screws 10 -12

- Lubricate the main bearing on the flywheel side half-crankcase.
- Lubricate the shim adjustment washer.
- Insert the shim adjustment washer on the crankshaft in its original position.
- Insert an 8 mm diameter pin into the hole on the countershaft.

- Insert the crankshaft on the pin and into the bushing.
- Before inserting thoroughly, make the oil pump gear align with the control gear.
- Complete the insertion and remove the pin.

N.B.

WHEN INSERTING THE SHAFT ON THE HALF-CRANKCASE, BE CAREFUL NOT TO DAMAGE THE MAIN BEARING WITH THE THREADED TANG OF THE CRANKSHAFT AND WITH THE TIMING CONTROL TOOTHED PINION.

- Install the oil pump closing plate.
- Tighten the 2 flanged fastening screws to the prescribed torque.

Locking torques (N*m)

Oil pump compartment closing bulkhead screw 8 - 10

Refitting the crankcase halves

- Remove the oil guard from the transmission side half-crankcase using a screwdriver.

- Install a new oil guard after lubricating it, using the special tool, arranging it at a 0.5 mm recess from the crankcase plane.

CAUTION

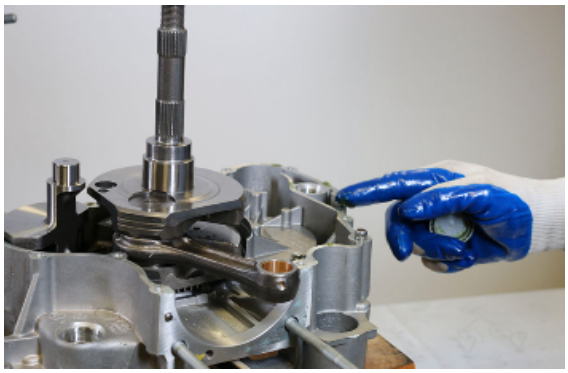
A WRONG POSITIONING OF THE OIL GUARD AFFECTS THE LUBRICATION OIL CIRCULATION.

Specific tooling

020360S 52 x 55 mm adaptor

020376Y Adaptor handle

- Insert the gasket on the flywheel side half-crankcase.



- Lubricate the main bearing on the transmission side half-crankcase.

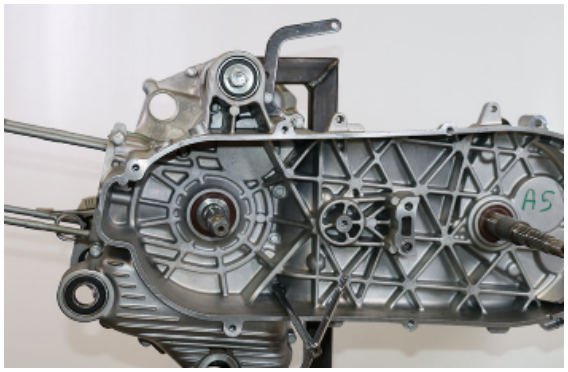
- Couple the 2 half-crankcases being careful not to damage the bushing on the transmission side half-crankcase with the threaded tang of the crankshaft.

- Insert the engine support retain screw on the flywheel side half-crankcase without tightening.

- Insert the 14 fixing screws according to the position noted during disassembly.
- Tighten the screws thoroughly and tighten to the prescribed torque.
- Check that the crankshaft rotates freely.

N.B.

REMOVE ANY EXCESS FROM THE CRANKCASE COUPLING GASKET ON THE CYLINDER PLANE, TO ENSURE BETTER SEALING PERFORMANCE.



Locking torques (N*m)

Engine-crankcase coupling screws **11 ÷ 13**

- Install the thermal group (cylinder, head, piston) as described in section «Thermal group and timing system».
- Install the flywheel with start-up control as described in the "Flywheel and start-up" chapter.
- Install the flywheel cover with the cooling system sleeves, as described in the "Flywheel cover chapter".
- Install the complete driving pulley, the transmission cover and the relevant mesh filter and the outside transmission cover as described in the «Automatic transmission» chapter.

Lubrication

TECHNICAL SPECIFICATIONS

SUMP CAPACITY

Specification	Desc./Quantity
Overhaul	1.7 l
Oil and filter replacement	1.5 l

RECOMMENDED ENGINE OIL

Product	Description	Specifications
Engine oil 5W -40	Synthetic-based lubricant for four-stroke engines.	SAE 5W-40; JASO MA, MA2; API SL; ACEA A3

OIL PUMP

Specification	Desc./Quantity
Type	Trochoidal
Rotor washers	8 mm
Assembly clearances	Lobe ends 0.05-0.008 mm
External rotor radial clearance	0.05- 0.12 mm
Rotor axial clearance	0.025 - 0.065 mm

BY-PASS

Specification	Desc./Quantity
Type	with piston
Plunger diameter	13.9 - 0.039 -0.057 mm
Spring free length	62.5 mm
Calibration pressure	4 bar

PRE-FILTER

Specification	Desc./Quantity
Type	mesh, plastic

OIL FILTER

Specification	Desc./Quantity
Type	paper with pressure relief and drain-back by-pass valves

MINIMUM OIL PRESSURE INDICATOR LIGHT SWITCH

Specification	Desc./Quantity
Calibration	0.3 - 0.6 bar

CYLINDER HEAD LUBRICATION NOZZLE

Specification	Desc./Quantity
Diameter	Ø 1 ± 0.05 mm *

** **Tightening torque** 5-7 N·m*

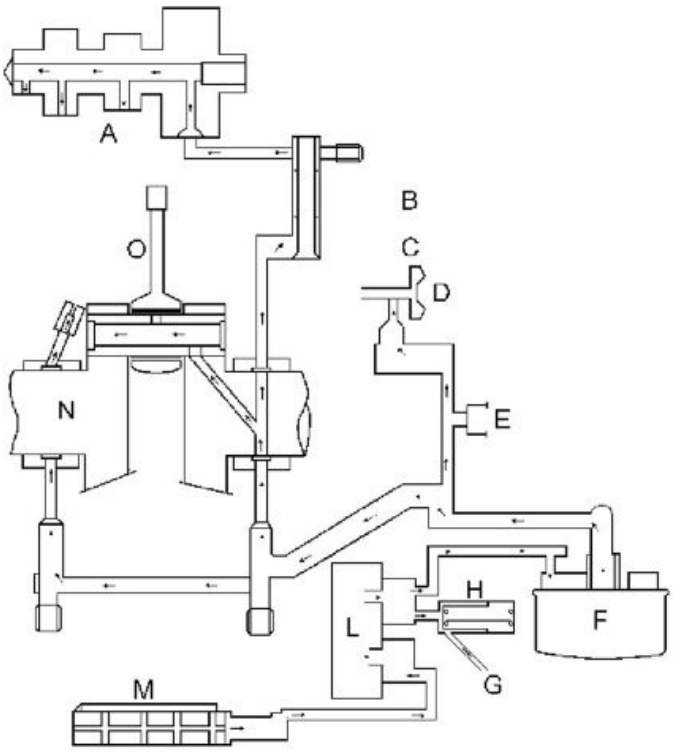
PISTON COOLING NOZZLE

Specification	Desc./Quantity
Diameter	0.8 ± 0.05 mm

CRANKCASE VENTILATION CHECK

Specification	Desc./Quantity
Device	metal reed valve and decantation chamber

Conceptual diagrams



PRINCIPLE DIAGRAM

Specification	Desc./Quantity
A	Camshaft
B	Cylinder-head plane
C	Cylinder-crankcase plane
D	Water pump impeller
E	Minimum oil pressure sensor

Specification	Desc./Quantity
F	Oil filter cartridge
G	To the oil sump
H	By-pass valve
L	Oil pump
M	Mesh pre-filter
N	Crankshaft
O	Connecting rod

General characteristics

The lubrication system is divided into two sections:

- High pressure

- Low pressure

The high pressure section includes all components located on the engine crankcase whereas the low pressure section only refers to the thermal group.

The trochoidal pump is installed in the sump and is controlled by a pair of gears.

To guarantee the integrity of the pump, a pre-filter is fitted.

This is a screw-in type pre-filter and the relevant plug serves at the same time as an engine oil drain plug.

The pump is controlled by means of a piston by-pass calibrated to 4 bar. This is located before the cartridge filter and both are installed on the flywheel cover, so that the seal of the filter is subject to the pressure of the circuit.

The by-pass located before the cartridge filter improves the operating conditions for the filter, particularly with cold oil.

The filter is equipped with an anti-drain back valve and a pressure-relief valve; the latter intervenes when the filtering mass causes a pressure drop above 1 ± 0.2 bar.

These conditions naturally occur only with cold oil and at high engine revs or if the filter is clogged.

The filtered oil is used to lubricate the water pump shaft and once at the engine crankcase, to lubricate the main bearings, the connecting rod head and the piston cooling nozzle, on the transmission-side bearing.

The main bearing on the transmission side is fitted with an oil seal and the respective drain line.

The supply line for the timing system comes from the flywheel-side bearing; the supply to the head is controlled by the respective spray jets in the engine crankcase.

The components of the timing system function with low-pressure oil lubrication.

The camshaft bearings are installed directly on the aluminium of the head; the camshaft axial clearance is partially compensated by the oil supplied to the smaller diameter bearing.

The camshaft supplies the lubricant to the rocking levers via the holes provided; these are installed in a position to ensure that the lubrication is maintained even after the scooter has stopped. This is achieved when the camshaft reaches its most usual and likely position when the engine is shut off.

The oil used to lubricate the head returns to the sump via the chain casing channel and therefore it also provides lubrication for the chain.

A one-way valve and a decantation chamber are used so that gases from the crankcase do not carry any oil. The one-way valve is a metal reed valve; the decantation chamber has a drainage hole. A failure in these components implies oil getting into the line supplying air to the engine.
Excessive oil vapours may result in clogged ducts on the throttle body.
In order to signal low oil pressure in the system, a pressure switch is used, located immediately after the oil filter outlet.
The lubrication circuit does not include the countershaft. The countershaft is lubricated by the oil transported by the gears or by the centrifugal effect of the crankshaft
The same applies to the piston or the pin, but in this case the cooling nozzle is particularly important.

Diagnosis guide

1 - Minimum oil pressure warning light on with hot engine.

AHEAD - go to 2

2 - Remove the minimum pressure switch electric connector.

Check that the warning light turns off.

YES - go to 3 NO go to 11

3 Check the actual oil pressure.

AHEAD - go to 4

4 - Remove the switch and fit the special tool with the relevant gasket.

Specific tooling

020193Y Oil pressure gauge

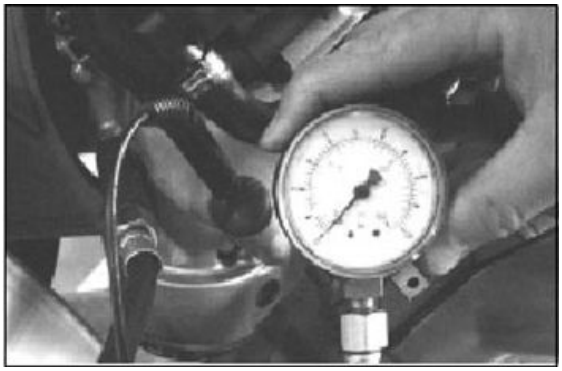
020434Y Union for oil pressure measurement

- Remove the dipstick with the oil filling cap and insert a cap fitted with the temperature probe supplied with the special tool. Insert the probe to feel contact with the crankcase bottom and pull back a few millimetres.

Specific tooling

020331Y Digital multimeter

AHEAD - go to 5



5 - Measure the pressure with cold and idling engine.

STANDARD VALUES

Specification	Desc./Quantity
20°C Temperature	
1400 rpm	

approx. 4.5 bar

N.B.

RPM CAN BE MEASURED BOTH BY THE EXHAUST GAS ANALYSER AND BY THE DIAGNOSTIC TESTER

Specific tooling

020922Y Diagnosis Tool

YES go to 6 NO go to 12

6 - Let the engine warm up and repeat the check with hot oil.

STANDARD VALUES

Specification	Desc./Quantity
80°C Temperature	
1400 rpm	

approx. 1.5 bar

YES go to 7 NO go to 8

7 - Replace the oil minimum pressure switch.

8 - If pressure lower than 1.3 ÷ 1.5 bar is measured.

AHEAD go to 9

9 - Replace the oil filter and repeat the pressure check with oil at 80°C.

YES go to 10 NO go to 13

10 - The failure was fixed.

It is recommended to respect the suggested number of kilometres covered.

11 - Check and restore the electrical system.

12 - If pressure lower than 4 bar is measured.

AHEAD go to 9

13 - Remove the flywheel cover and check the by-pass and the cover sealing gasket efficiency towards the case internal side, as described in the "Flywheel cover" chapter.

YES go to 14 NO go to 15

14 - Check whether there is an irregular clearance on the crankshaft:

- axial clearance (see the "Crankcase and crankshaft" chapter)
- radial clearance, especially in the direction of the cylinder axis
- clearance according to the direction of rotation with the connecting rod in quadrature

YES go to 16 NO go to 17

15 - Replace the faulty components ("Flywheel cover" chapter).

16 - Overhaul the engine ("Crankcase and crankshaft" chapter).

17 - Open the engine crankcase and remove the oil pump as described in the "Crankcase and crankshaft" chapter.

- Check the oil pump as described in the following pages.
- Check that the cooling nozzle and the timing system feeding jet are properly installed.
- Visually inspect the crankshaft couplings and their size ("Crankcase and crankshaft" chapter).

N.B.

POTENTIAL IRREGULARITIES IN COUPLINGS AND THE TIMING SYSTEM COMPONENTS CANNOT BE DETECTED WHEN INSPECTING THE LUBRICATION PRESSURE. THEY MAY BECOME EVIDENT BY AN INCREASE IN NOISE.

N.B.

IN CASE OF IRREGULAR PRESSURE ON THE CRANKCASE, CARRY OUT A VISUAL AND DIMENSIONAL INSPECTION OF THE TIMING SYSTEM COMPONENTS (SEE "THERMAL GROUP AND TIMING SYSTEM" CHAPTER).

Oil pressure check

1 - In case of oil leaks from the oil filter or from the flywheel cover coupling gasket, check the lubrication pressure.

AHEAD go to 2

2 - Install the special tool.

Specific tooling

020193Y Oil pressure gauge

020434Y Union for oil pressure measurement

AHEAD go to 3

3 - Check the system pressure with cold engine and medium - high speed.

Standard pressure < 6 bar

YES go to 4 NO go to 5

4 - Replace the damaged components.

5 - Check the working order of the adjustment by-pass (see "flywheel cover" chapter) and restore proper sliding.

N.B.

STANDARD PRESSURES ARE OBTAINED USING OIL WITH THE PRESCRIBED VISCOSITY. A HIGHER VISCOSITY CAUSES AN INCREASE OF THE SYSTEM PRESSURE.

1 - If oil consumption is above 250 g/1000 km on a run-in engine, proceed as follows.

AHEAD go to 2

2 - Check the presence of oil in the scavenge duct on the filter box.

YES go to 3 NO go to 4

3 - Check the one-way reed valve and the decantation chamber drainage hole.

YES go to 5 NO go to 4

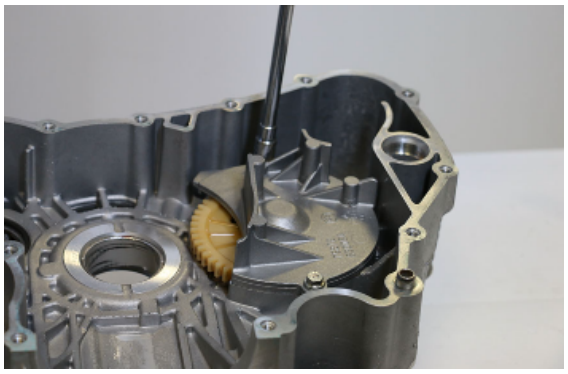
4 - Check the thermal group seals (piston rings, valve guides and oil guards), see "Thermal group and Timing system" chapter.

5 - Restore the valve or the drainage hole efficiency.

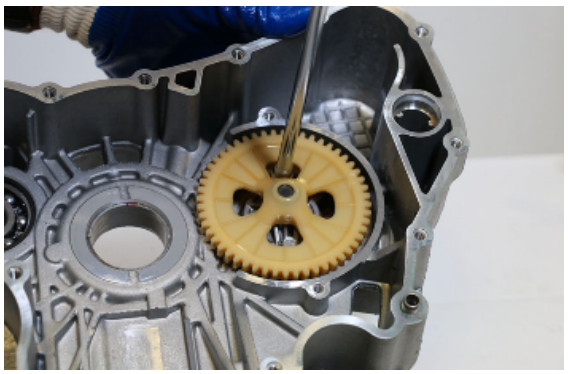
Oil pump

Removal

- Remove the closing plate of the oil pump housing by loosening the 2 retaining screws with their washers.



- Unscrew the oil pump fixing screws, through the slots on the gear.
2 screws



- Remove the oil pump including the gear and gasket

- Remove the two screws and the oil pump cover.

- Remove the inside rotor retaining snap ring turning it to move the opening at the shaft face.

- Remove and wash the rotors thoroughly with petrol and compressed air.
- Extract the shaft with its gear and check that it is in good working order and free from wear.

- Reassemble the rotors in the pump body, keeping the two reference marks visible.
- Insert the shaft with the gear and install the lock ring; then, turn it with the opening opposed to the shaft face.
- Check any irregular clearance between shaft and pump body.

- Using a feeler gauge, check the distance between the rotors in the position shown in the figure.

Characteristic

Admissible limit clearance:

0.012 mm

Measure the distance between the outer rotor and the pump body (see figure).

Characteristic

Admissible limit clearance:

0.25 mm

- Check the axial clearance of the rotors using a trued bar as reference as shown in the figure.

Characteristic

Limit value admitted:

0.1 mm

Refitting

- Make sure the gasket is in the correct position.

N.B.

THE TOOTH OF THE GASKET MUST BE IN ITS SEAT.

- Lubricate the internal rotors.
- Check there are no signs of scoring or wear on the oil pump cover.
- If non-conforming values or signs of wear are found, replace the pump.
- Fit the pump cover in the position that permits the crankcase fixing screws to be aligned.
- Tighten the two fastening screws to the prescribed torque.

Locking torques (N*m)

Oil pump cover screws **0.7 - 0.9**

- Insert the oil pump with gear

- Insert the 2 retaining screws through the slots on the gear and tighten to the prescribed torque.

N.B.

THE ASSEMBLY POSITION OF THE PUMP IS FIXED BY INSTALLATION OF THE SCREWS.

Failure to observe the tightening torque may alter the coupling clearance of the rotors with the pump body.

Locking torques (N*m)

Screws fixing oil pump to the crankcase 5 to 6

- Insert the countershaft with gearing into the fly-wheel-side half-crankcase.
- Install the special tool in the position shown in the figure.

Specific tooling

020479Y Countershaft lock wrench

- Keep the countershaft in position and insert the washer with the nut.
- Tighten the nut to the prescribed torque, using the recommended product.
- Remove the special tool.

Recommended products

Loctite 243 Medium strength thread-locking sealant.

Blue

Locking torques (N*m)

Countershaft fixing nut 25 ÷ 29

Water pump

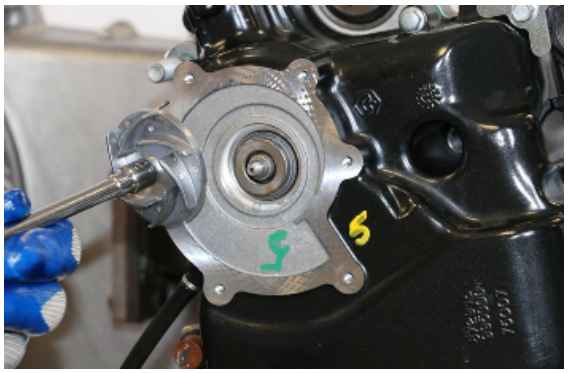
Removal

Specific tooling

020661Y Water pump overall seal replacement kit

- Remove the six screws and the pump cover with a screwdriver.

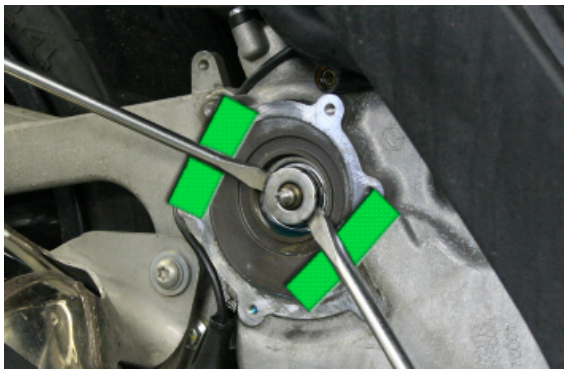
- Unscrew the water pump rotor with an 8-mm wrench.



- Place two flat blade screwdrivers as shown in the figure so as to lever on the marked crankcase edge and disassemble the overall seal, pressure-fitted on the rotor shaft.

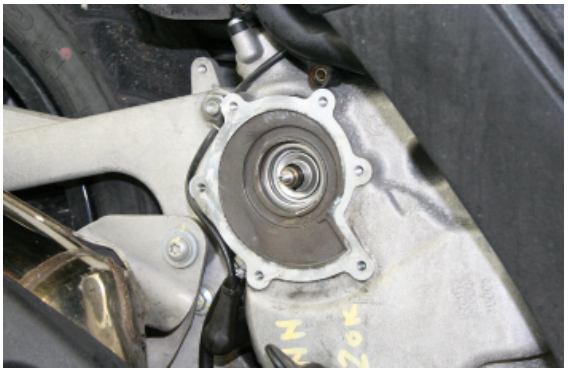
CAUTION

USE TEFLON AS SHOWN IN THE FIGURE SO AS NOT TO DAMAGE THE WATER PUMP COVER SEALING SURFACE. SMALL SCRATCHES ON THE SEAT EDGE DO NOT POSE FUNCTIONAL PROBLEMS.



- Change the position of the screwdrivers if necessary.
- During seal disassembly, the ceramic may split.

- Clean all the parts thoroughly before removing them.



- Place the extractor together with the pin on the fixed part of the ceramic seal.
- Without modifying the extractor position, make three holes on the fixed part of the seal using the pin supplied and a hammer.

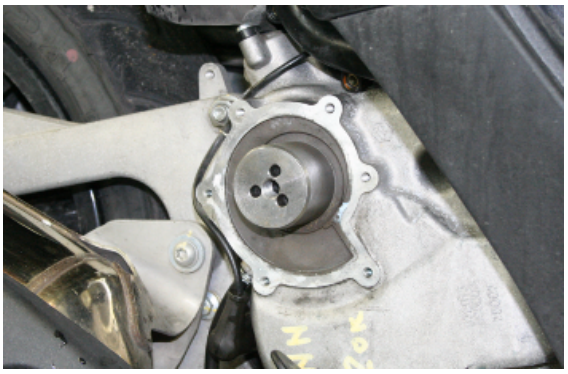
N.B.

MAKE THE HOLES WITH A STRONG HIT.
MULTIPLE LIGHT BLOWS COULD DEFORM THE PART WITHOUT PASSING THROUGH.

- Fix the extractor to the fixed part of the sealing using the screws supplied with the tool.

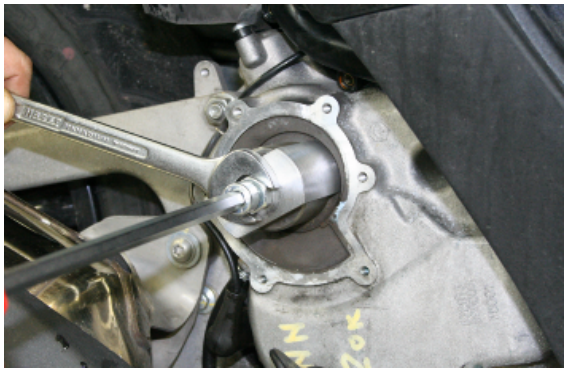
CAUTION

FIX IT PROPERLY WITHOUT "TEARING" THE PLATE



- Complete the tool by fitting the bracket, the screw and the nut.

- Hold the screw in position and operate the nut until the fixed part of the sealing is completely removed.
- Remove the extractor with the fixed part of the overall seal.



Fitting

Specific tooling

020661Y Water pump overall seal replacement kit

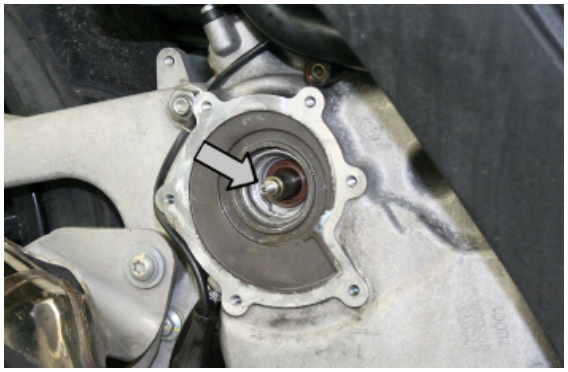
OVERALL SEAL FITTING

CAUTION

CLEAN ALL THE COMPONENTS THOROUGHLY.

CAUTION

LUBRICATE THE ROTOR SHAFT WITH ENGINE OIL.

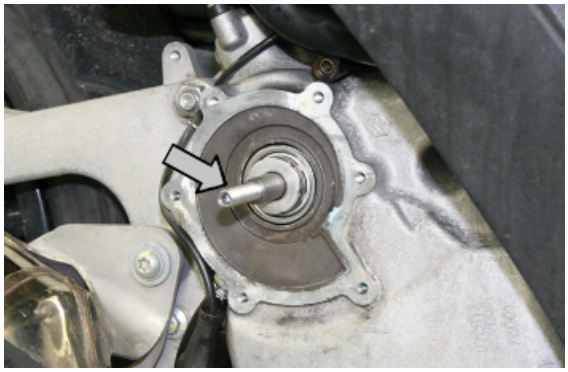


- Fit the tie rod by screwing it to the rotor shaft.

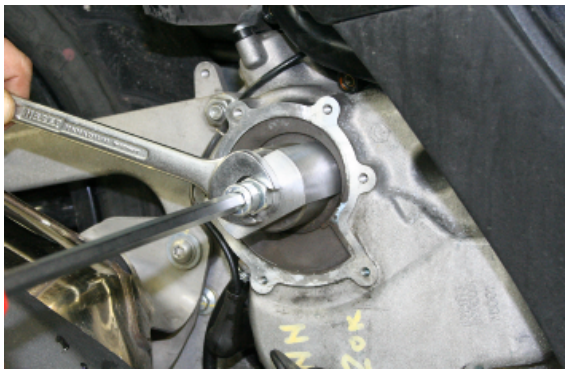
CAUTION

TIGHTEN MANUALLY UNTIL IT STOPS.

- Place the overall seal on the shaft.



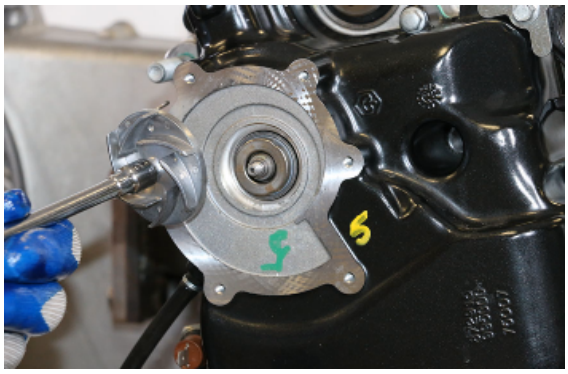
- Place the calibrated punch (at preloading value).
- Fit the nut to the tie rod.
- Keep the tie rod in position and screw the nut up to the end of stroke.
- The tool will drive the fixed part seat on the crank-case and the movable part seat on the shaft, thus obtaining the correct ceramic seal preloading.



- Screw the rotor.

Locking torques (N*m)

Water pump rotor 4 ÷ 5



- Fit the pump cover with a new gasket, lubricate the gasket previously with petroleum jelly grease.
- Tighten the six cover screws to the prescribed torque.

N.B.

TO AVOID DEFORMATION, DO NOT LUBRICATE THE O-RING WITH PETROLEUM GREASE.

Locking torques (N*m)

Water pump cover screws 3 - 4

Retromarcia

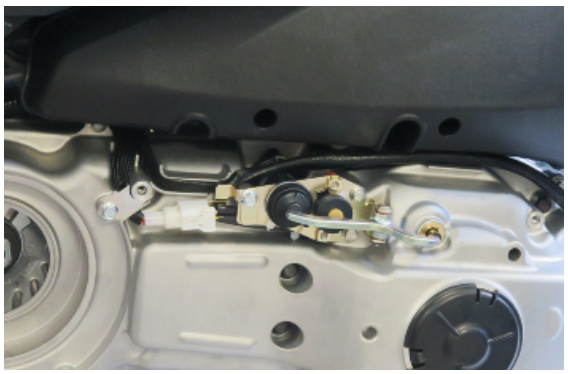
REVERSE GEAR ACTUATOR UNIT

To disassemble the reverse gear actuator unit, remove the transmission protection cover screws (4 screws).

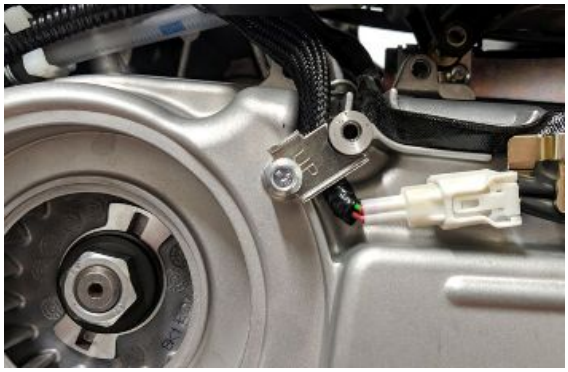
Remove the transmission protection cover.

To facilitate access to the components, if necessary remove the filter box fittings (2 screws) and lift it slightly.

A solenoid is mounted on the central part of the transmission cover, used to manage the engagement of the reverse gear.
There is also a linear sensor, which detects the position of the engagement lever and enables the reverse gear.



Unscrew the screw of the wiring harness retaining plate and remove it.



Remove the fasteners of the reverse gear actuator unit (3 screws).

Disconnect the connector and remove the unit.

CAUTION

WARNING

TO RELEASE THE FASTENING PIN OF THE CONNECTOR, PRESS AS SHOWN IN THE IMAGE.

The contact box of the reverse gear motor positive cable contacts is fastened on the left side, at the top.

REVERSE GEAR MOTOR AND GEARS REMOVAL

Unscrew the plate nuts, remove it and disconnect the positive cable of the reverse gear motor.

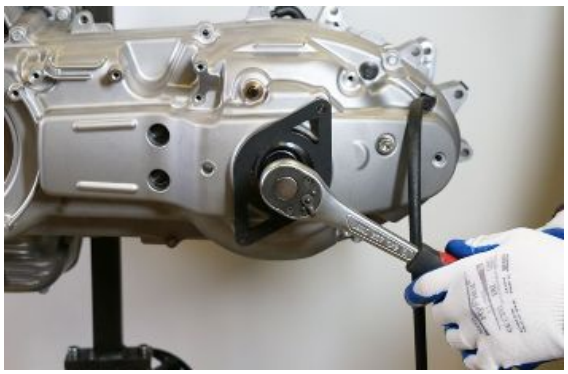
- Use a screwdriver to remove the driven pulley axle plug.

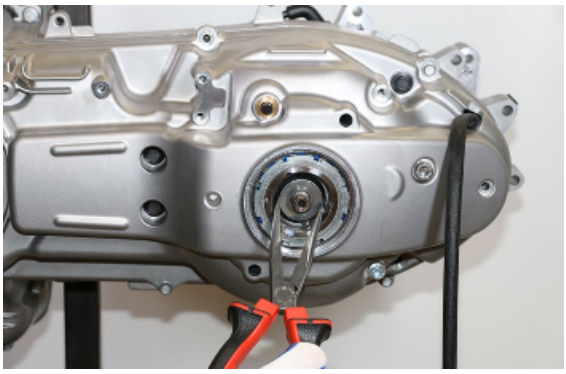
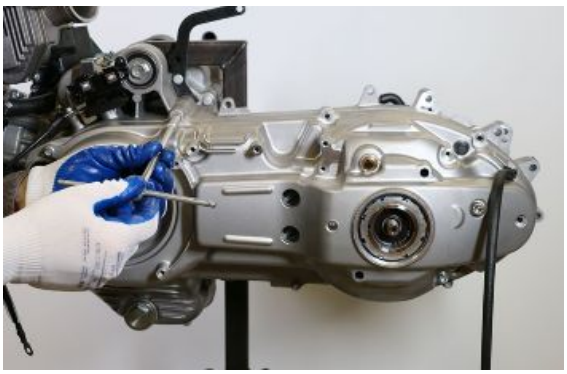
Insert the specific tool in the appropriate slots.

Specific tooling

021022Y Driven pulley stop

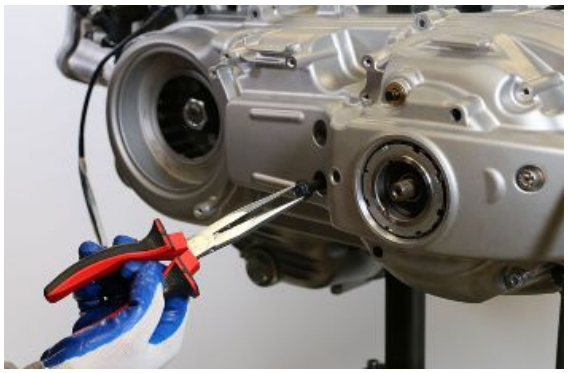
Unscrew the driven pulley shaft nut.



Remove the nut.	
Remove the specific tool.	
Remove the two washers.	
Remove the transmission cover screws (7 M6 screws).	

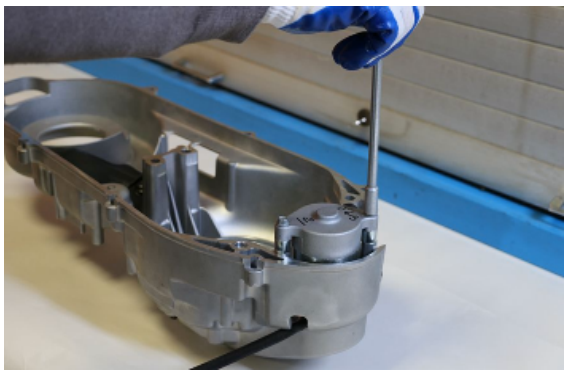
Remove the screws from the right side of the cover (2 M8 screws).

Remove the screws from the central part (2 M8 screws).



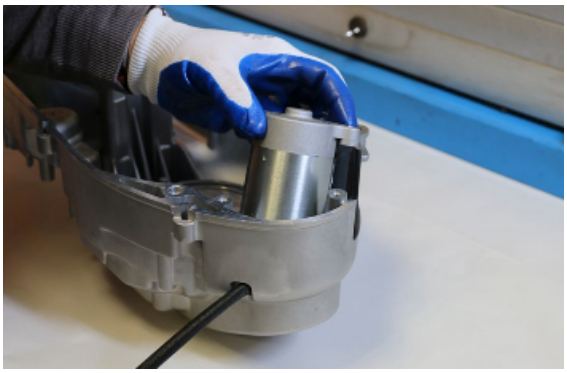
Remove the transmission cover.

Remove the reverse gear motor fixing screws (2 screws).



Remove the spacers.

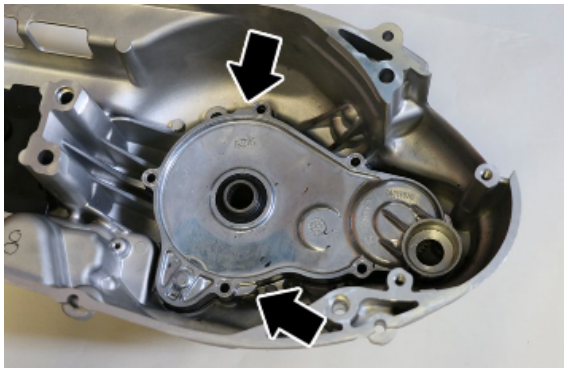
Prepare a suitable container for draining the oil.
Remove the motor by taking out the cable from the crankcase slot.
Rotate the entire crankcase cover to drain the oil contained in the reverse gear system.



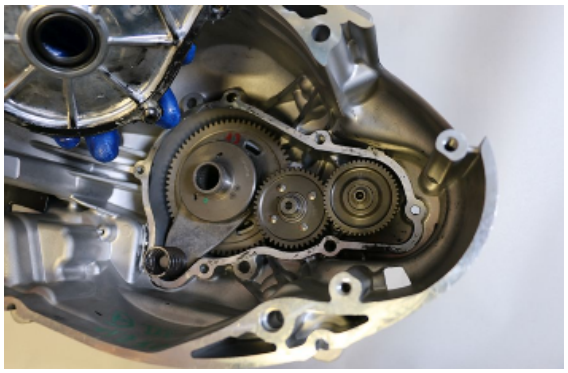
Remove the reverse gears cover internal screws (5 screws).

Remove the external screw.

To remove the cover, apply force on the two protrusions shown in the image.
Only if high resistance is encountered, heat the area to facilitate the operation.



Remove the reverse gears cover.



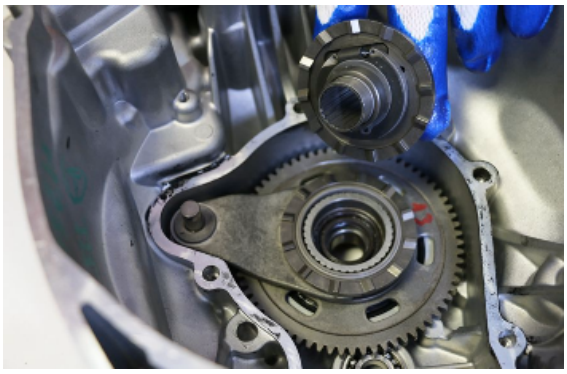
Remove the spring.

Remove the first gear.

Remove the second gear.

Remove the shaft.

Remove the transmission bushing.

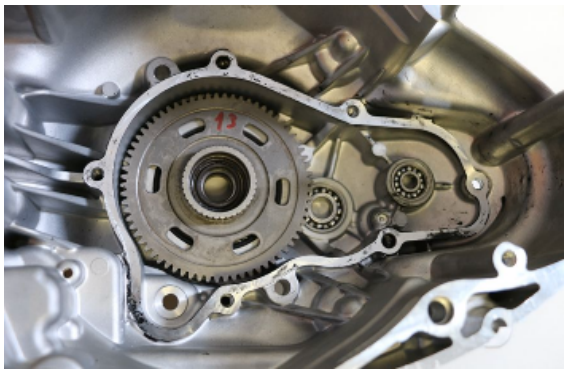


N.B.

THE TRANSMISSION BUSHING IS EQUIPPED WITH A SAFETY SYSTEM THAT MECHANICALLY PREVENTS THE ENGAGEMENT OF THE REVERSE GEAR WHEN THE DRIVEN PULLEY SHAFT EXCEEDS A CERTAIN ROTATION SPEED.

Remove the gear control fork unit and the selector by raising it evenly.

Remove the control bushing.

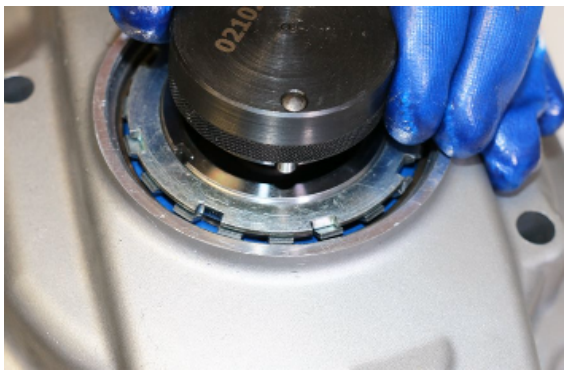


Insert the specific tool from the outside of the transmission cover.

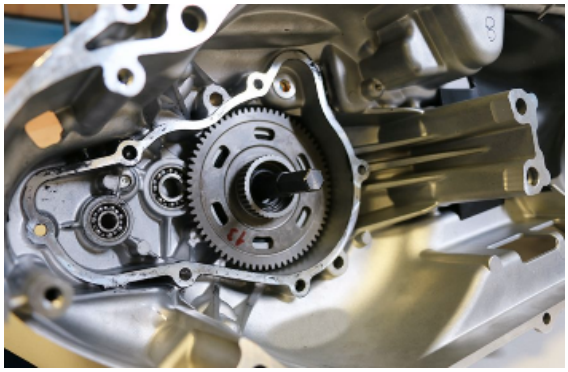
Specific tooling

021024Y Control bushing stopper wrench

Pay attention to the tool protrusion, which must be inserted into the internal cavity, as shown in the image.



The tool has two functions: to keep the control bushing blocked and to act as support for the transmission cover during removal.



Fasten the other part of the specific tool to a vice.

Specific tooling

021024Y Control bushing stopper wrench

Place the transmission cover on the vice, inserting the two parts of the tool one inside the other.

Using a pin punch, bend the locking washer sear downwards.

Place the specific tool on the ring nut, inserting the teeth of the tool into the ring nut slots.

Specific tooling

021023Y Ring nut locking wrench

Loosen the ring nut.

Remove the transmission cover from the vice and remove the specific tools.

Support the control bushing from the inside of the cover, unscrew the ring nut and remove the lock washer.

Remove the control bushing.

REVERSE GEAR MOTOR AND GEARS FITTING

N.B.

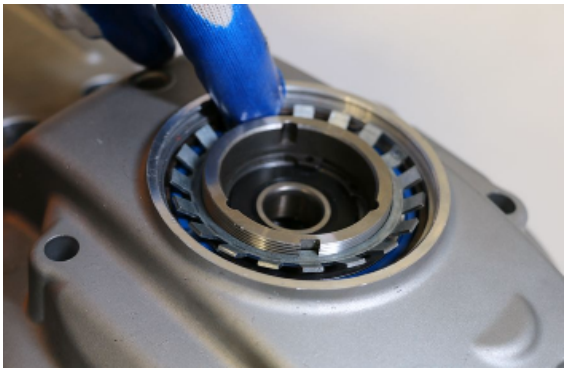
BEFORE MOUNTING THE CONTROL BUSHING, LUBRICATE THE SEAL RING LOCATED ON THE TRANSMISSION COVER AND THE MATING SURFACE OF THE BUSHING.

Recommended products

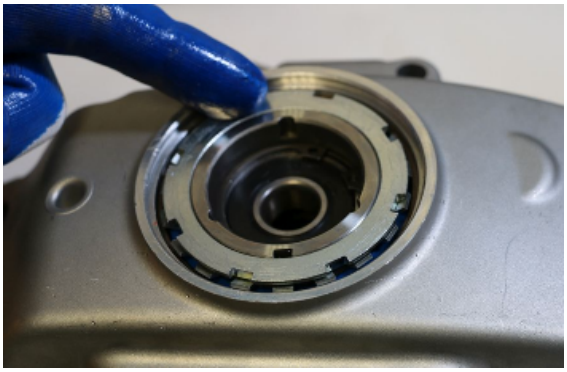
Transmission oil 80W-90 Lubricant for gearboxes and transmissions.

SAE 80W-90 API GL-4

Insert the control bushing from the inner side of the transmission cover and the lock washer from the opposite side.



Tighten the ring nut manually.

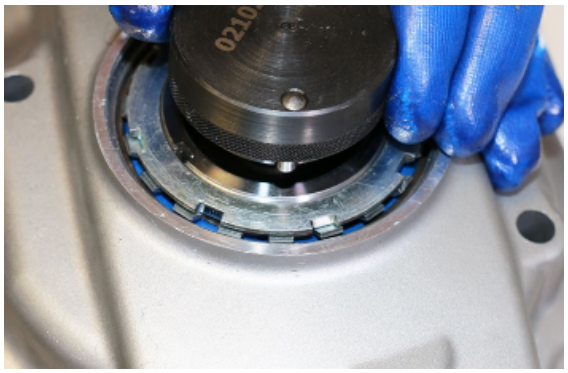


Insert the specific tool from the outside of the transmission cover.

Specific tooling

021024Y Control bushing stopper wrench

Pay attention to the tool protrusion, which must be inserted into the internal cavity, as shown in the image.



Fasten the other part of the specific tool to a vice.

Specific tooling

021024Y Control bushing stopper wrench

Place the transmission cover on the vice, inserting the two parts of the tool one inside the other.

Place the specific tool on the ring nut, inserting the teeth of the tool into the ring nut slots.

Specific tooling

021023Y Ring nut locking wrench

Tighten the ring nut, applying the recommended torque.

CAUTION

WARNING

AFTER TIGHTENING, BEND A TOOTH OF THE STOP WASHER IN ONE OF THE EXTERNAL CAVITIES OF THE RING.

Locking torques (N*m)

Reverse gear control bushing ring nut 66-74 Nm (49-55 lb*ft)

Remove the transmission cover from the vice and remove the specific tools.

Fit the gear control fork unit and the selector.

N.B.

LUBRICATE THE AREA OF THE GEAR CONTROL FORK PIN.

Recommended products

Transmission oil 80W-90 Lubricant for gear-boxes and transmissions.

SAE 80W-90 API GL-4

Fit the unit on the control bushing.

N.B.

BEFORE FITTING, APPLY THE RECOMMENDED OIL BETWEEN THE TEETH (SPLINES) OF THE CONTROL BUSHING AND THE GEAR SELECTOR.

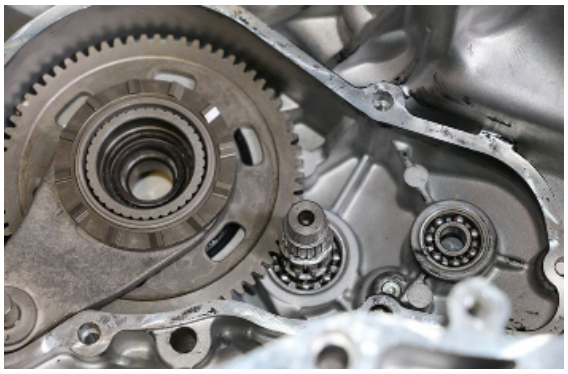
Recommended products

Transmission oil 80W-90 Lubricant for gearboxes and transmissions.

SAE 80W-90 API GL-4

Fit the transmission bushing.

Fit the spindle.



Mount the first gear with the flexible coupling side facing down, as shown in the figure.

Fit the second gear.

Insert the spring.

CAUTION

WARNING

N.B.

BE CAREFUL THAT THERE IS NO SEALANT APPLIED ON THE EXTERNAL PART OF THE CONTROL GUIDE HOLE.

Clean the mating surface, apply the specific sealing product and place the reverse gear cover.

Recommended products

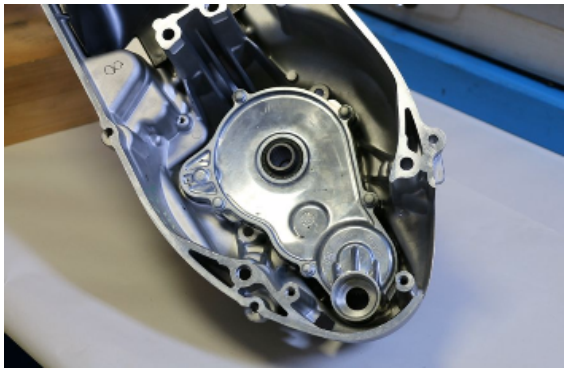
THREE BOND TB1207B Liquid sealant

Three Bond liquid gasket TB1207B

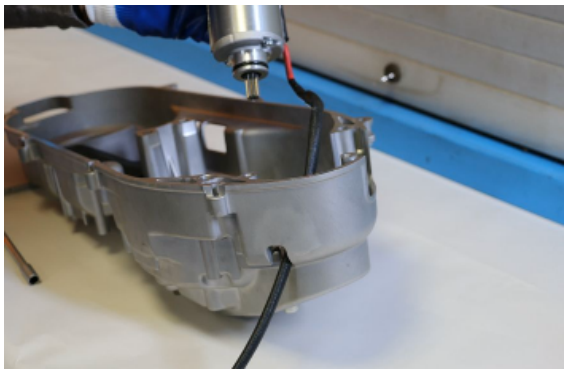
Screw the inner screws of the cover (5 screws).

Locking torques (N*m)

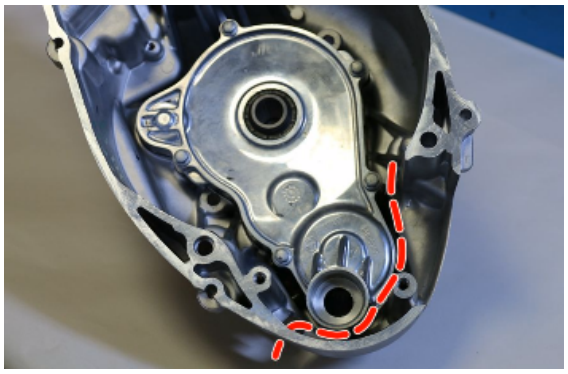
Reverse gear system cover screws 11 - 13 Nm (8 -10 lb*ft)



Place the motor and pass the cable through the specific slot.



Place the motor cable and the cap as shown in the figure.



Insert the spacers.

Screw the motor fixing screws (2 screws).

Locking torques (N*m)

Reverse gear motor fastening screws **11 - 13 Nm (8 -10 lb*ft)**

Position the transmission cover.

CAUTION

WARNING

THE FOUR M8 SCREWS OF THE TRANSMISSION COVER HAVE DIFFERENT LENGTHS: THE TWO LONG SCREWS MUST BE FITTED ON THE CENTRAL PART, THE TWO SHORT SCREWS ON THE RIGHT SIDE.

Screw the screws on the central part (2 long M8 screws).

Locking torques (N*m)

M8 transmission cover fastenings **23 - 26 Nm (17 -19 lb*ft)**

Screw the screws on the right side (2 short M8 screws).

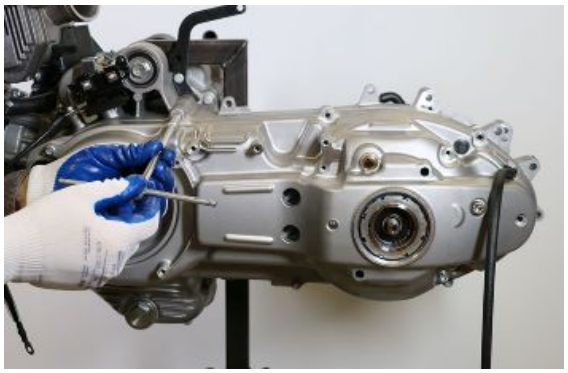
Locking torques (N*m)

M8 transmission cover fastenings **23 - 26 Nm (17 -19 lb*ft)**

Screw the transmission cover screws (7 M6 screws).

Locking torques (N*m)

M6 transmission cover fastenings **11 - 13 Nm (8 -10 lb*ft)**



Fit the two washers as shown in the image; first the one with the smaller diameter, then the one with the larger diameter.

Insert the specific tool in the appropriate slots, if necessary rotate the shaft to engage it fully.

Specific tooling

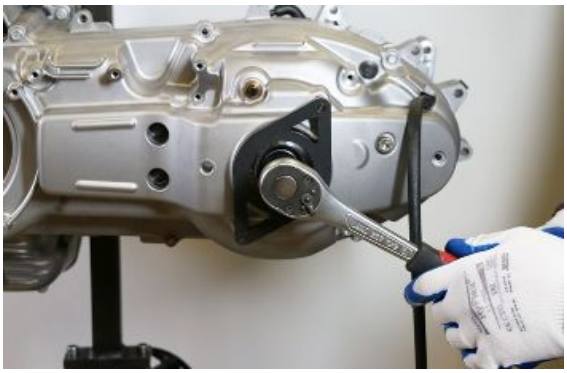
021022Y Driven pulley stop

Fit the driven pulley axle nut.

Tighten the nut to the prescribed torque.

Locking torques (N*m)

Driven pulley nut **92 - 100 Nm (68 -74 lb*ft)**



Remove the specific tool.

Fit the driven pulley axle plug.

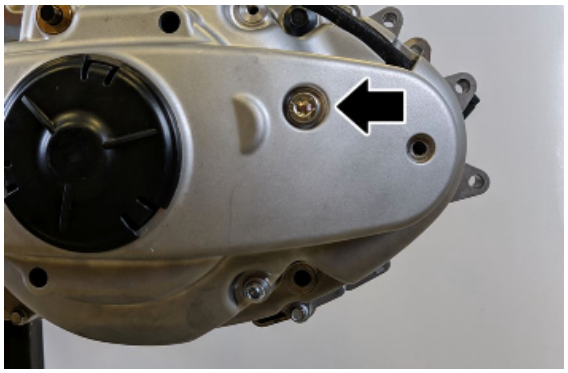
Connect the positive cable of the reverse gear motor, place the plate and fasten it with the specific nuts.

CAUTION

WARNING

CHECK AND CLEAN THE CONTACTS: IMPROPER MAINTENANCE STATE MAY CAUSE MALFUNCTIONS WHICH CAN ENTAIL FIRE RISKS.

Fill the installation through the filler hole.



Recommended products

Transmission oil 80W-90 Lubricant for gearboxes and transmissions.

SAE 80W-90 API GL-4

Characteristic

Reverse gear system oil

90 cm^3

Locking torques (N*m)

Reverse gear system oil relief screw 15-17 Nm (11-13 lb*ft)

INDEX OF TOPICS

Precautions

1. Before repairing any part of the injection system, check if any faults have been stored. Do not disconnect the battery before checking for faults.
2. The fuel supply system is pressurised at ~ 350 kPa (3.5 BAR). Before disconnecting the fast-release fitting of the fuel supply pipe, check that there are no naked flames. Do not smoke. Act with caution to avoid spraying fuel to your eyes.
3. When repairing electric components, the battery must always be disconnected unless it is strictly necessary for the battery to be connected.
4. When functional checks are performed, make sure that the battery voltage exceeds 12V.
5. Before attempting to start the vehicle, ensure that there are at least two litres of fuel in the tank. Failure to respect this norm will damage the fuel pump.
6. If a long period is envisaged with the vehicle not in use, fill the tank to at least the halfway mark. This will ensure the pump will be covered by fuel.
7. When washing the vehicle, do not spray excessive water on electric components and wiring harnesses.
8. In the event of ignition problems, begin troubleshooting from the battery and the injection system connections.
9. Before disconnecting the injection ECU connector, perform the following steps in the order shown:
- Set the switch to «**OFF**»
- Disconnect the battery
Failure to respect this norm may damage the control unit.
10. Do not invert the poles when fitting the battery.
11. To avoid causing any damage, disconnect and reconnect the injection system connectors only if required. Before reconnecting, check that the connectors are dry.
12. When carrying out electric inspections, do not force the tester probes into the connectors. Do not take measurements not specifically foreseen by the manual.
13. At the end of every check performed with the diagnostic tester, remember to protect the system connector with its cap. Failure to observe this precaution may damage the injection control unit.
14. Before reconnecting the quick couplers of the power supply system, check that the terminals are perfectly clean.

Troubleshooting tips

1. An injection system failure is more likely to be due to the connections rather than to the components. Before troubleshooting the system, carry out the following checks:
A: Electrical power supply
a. Battery voltage
b. Blown fuse
c. Relays

d. Connectors

B: Frame ground

C: Fuel system

a. Faulty fuel pump

b. Dirty fuel filter

D: Ignition system

a. Faulty spark plug

b. Faulty coil

c. Faulty shielded cap

E: Intake circuit

a. Air filter dirty

b. b. Dirty by-pass circuit

c. Faulty stepper motor

F: Other

a. Wrong timing system

b. Wrong idle mixture

c. Wrong reset of the throttle valve position sensor

2. Failures in the injection system may be caused by loose connectors. Make sure that all connections are properly implemented.

Check the connectors taking into consideration the following point:

A: check that the terminals are not bent.

B: check that the connectors have been properly connected.

C: check whether the failure changes if the connector is slightly vibrating.

3. Check thoroughly the entire injection system before replacing the control unit. If the fault is fixed even by replacing the control unit, install the original control unit again and check if the fault occurs again.

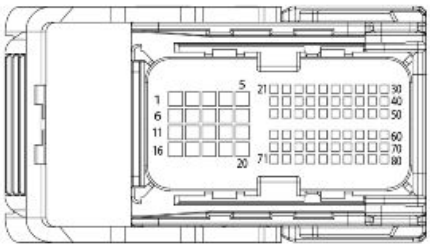
4. For troubleshooting, use a multimeter with an internal resistance of more than 10KW/V. Improper instruments may damage the injection control unit. The instruments to be preferred have a definition over 0.1V and 0.5W and an accuracy over 2%.

Terminals setup

INJECTION ECU CONNECTOR (GROUND)

1. Ground (Black-Red)

INJECTION ECU CONNECTOR (ENGINE)



1. Throttle body (Grey-Black)

2. Not connected

3. Not connected

4. Not connected

5. Canister (White - Black)

6. Throttle body (Red-Blue)

7. Not connected

8. Not connected

9. Not connected

10. Lambda probe heater (White-Blue)

11. Not connected

12. Not connected

13. Not connected

14. Not connected

15. Injector (Red-Yellow)

16. Not connected

17. H.V. coil. (Pink-Black)

18. Not connected

19. Not connected

20. Not connected

21. Not connected

22. Throttle body (Orange-White)

23. Lambda probe () (Light Blue-Black)

24. Lambda probe (+) (Green-Blue)

25. Not connected

26. Not connected

27. Not connected

28. MIL warning light (White-Brown)
29. Reverse gear solenoid relay (Light blue-Red)
30. Immobilizer warning light (Yellow)
31. Not connected
32. Not connected
33. Not connected
34. Not connected
35. Not connected
36. Not connected
37. Not connected
38. Reverse gear buzzer (Blue)
39. Not connected
40. ASR indicator light (Brown-Blue)
41. Not connected
42. Not connected
43. Not connected
44. Ground sensors (Grey-Green)
45. Not connected
46. Sensors ground (Black-Yellow)
47. Not connected
48. Not connected
49. Reverse gear motor relay (White-Purple)
50. Not connected
51. Throttle body (Green-Orange)
52. Not connected
53. Not connected
54. Sensors power supply (Brown-Red)
55. Not connected
56. Not connected
57. Sensors power supply (Red-Green)
58. Not connected
59. LH Stop button (White-Grey)
60. Pick-up (+) (Red)
61. Not connected
62. Not connected
63. T-MAP sensor (temperature) (Yellow-Blue)
64. Not connected
65. Not connected

66. Not connected

67. Sensors supply (Red-Black)

68. Not connected

69. Not connected

70. Pick-up (-) (Brown)

71. T-MAP sensor (pressure) (Yellow-Green)

72. Not connected

73. Engine temperature sensor (Light blue-Green)

74. Not connected

75. Ground sensors (Grey-Brown)

76. Not connected

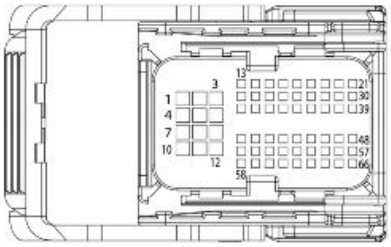
77. Not connected

78. ASR button (Light Blue-White)

79. Not connected

80. Not connected

INJECTION ECU CONNECTOR (VEHICLE)



1. Battery positive from injection load relay (Black-Green)

2. Battery positive from injection load relay (Black-Green)

3. Battery powered (Red-Green)

4. Battery positive from injection load relay (Black-Green)

5. Ground lead (Black)

6. Ground lead (Black)

7. Not connected

8. Ground lead (Black)

9. Not connected

10. Reverse gear enable relay (Blue)

11. Stop lights relay (Green-White)

12. Not connected

13. Live supply (Orange-Blue)

14. Not connected

15. Starter button (Purple)

16. Starter relay (Red)

17. Engine stop switch (Grey)

18. Injection load relay (Black-Purple)

19. Instrument panel (Green)
20. Electric fan relay (White)
21. Immobilizer antenna (Orange-White)
22. Not connected
23. Brake pedal stop button (White-Grey)
24. Not connected
25. Drive / Reverse mode selector (D) (Light blue)
26. Engine stop relay (Yellow-Blue)
27. Not connected
28. Not connected
29. MIL warning light (Brown-Yellow)
30. Not connected
31. Drive / Reverse mode selector (R) (Grey-Black)
32. RH stop button (Pink-Green)
33. Not connected
34. Not connected
35. Not connected
36. Not connected
37. Not connected
38. Fuel pump relay (Purple-Black)
39. Not connected
40. Not connected
41. Not connected
42. Sensors ground (Light Blue-Black)
43. Sensors ground (Brown-Black)
44. Sensors ground (Black-Yellow)
45. Not connected
46. Not connected
47. Not connected
48. CAN H line (Pink-Red)
49. Reverse gear actuator unit (Brown)
50. Sensors power supply (Light blue-Red)
51. Sensors power supply (Brown-Red)
52. Sensors power supply (Light blue-Green)
53. Ground sensors (Grey-Green)
54. Not connected
55. Not connected

56. Not connected

57. CAN L Line (Pink-White)

58. Not connected

59. Throttle grip position sensor (Light blue-White)

60. Throttle grip position sensor (Light blue-Yellow)

61. Throttle grip position sensor (Brown-White)

62. Fall sensor (Orange-Green)

63. Not connected

64. Not connected

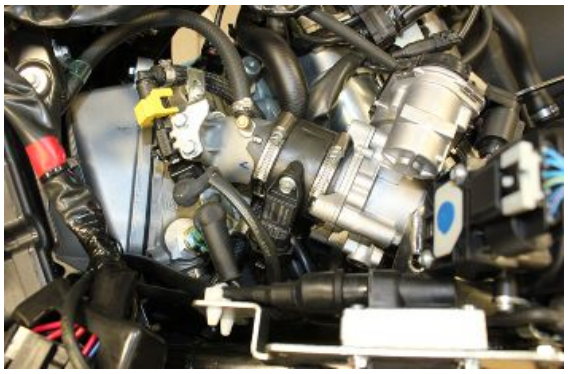
65. Starter relay (Purple-White)

66. Ground (Black-Red)

Removing the butterfly valve

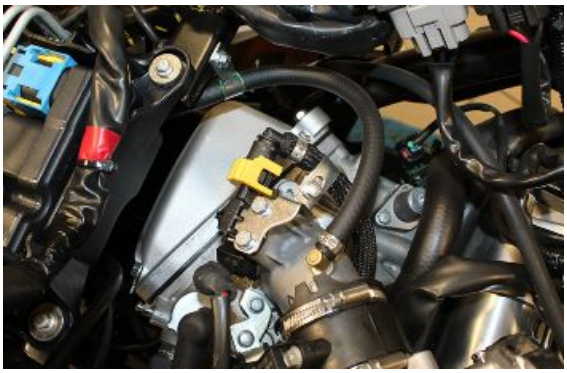
- Disconnect the connector from the injector.

- Disconnect the T-MAP sensor connector.

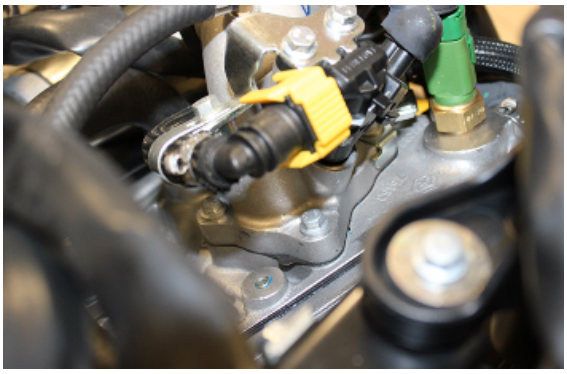


- Disconnect the throttle body connector.

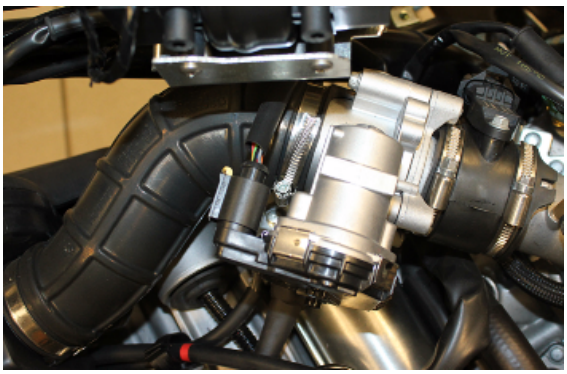
- Remove the corresponding stop and disconnect the fuel piping.
- Unscrew the bolt fixing the fuel piping to the engine head.



- Remove the three screws fixing the manifold to the cylinder head.



- Remove the throttle body fastening clamp to the manifold.



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Refitting the rear wheel

- Put the wheel on the axle and put it all the way on with the hub.

- Align the holes between the wheel and the hub, then screw on the five fixing bolts of the wheel.

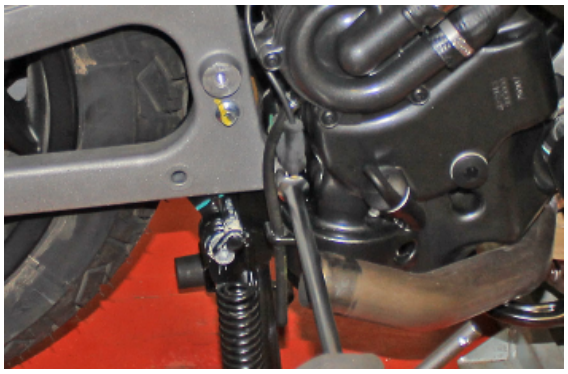
- Insert the spacer.

- Place the bracket all the way onto the wheel axle.

- Fit the ABS sensor on the bracket.

- Fix the two screws of the sensor support.

- Screw in the three fasteners of the bracket to the stand.

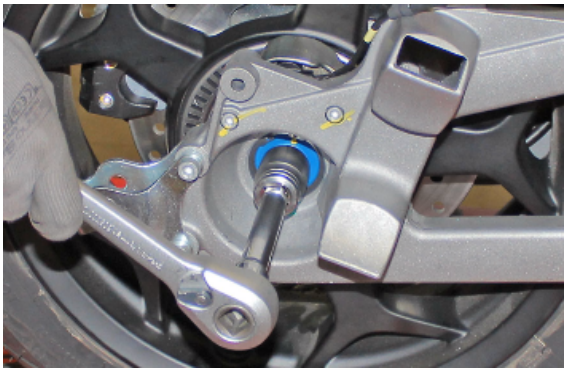


- Insert the spacer on the wheel hub.

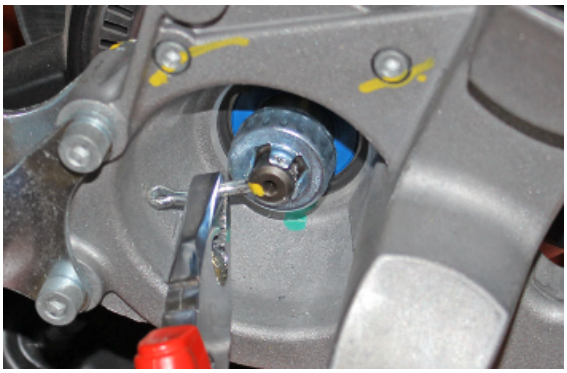
- Screw in the wheel axle nut and tighten to the recommended torque.

Locking torques (N*m)

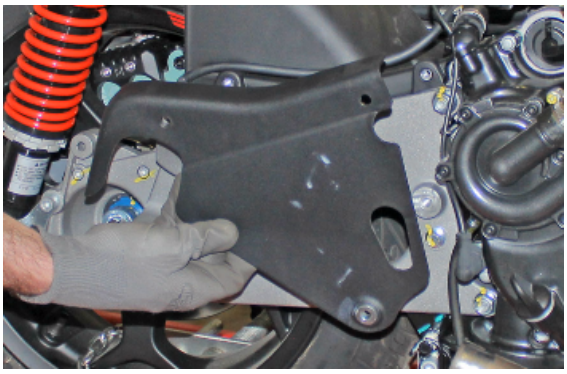
Rear wheel axle **104 - 126 Nm (77 -93 lb*ft)**



- Fit the cap and insert a new cotter pin.



- Fit the mudguard.
- Put the bracket cover.

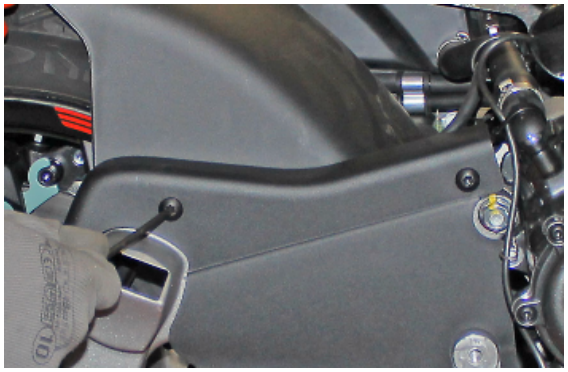


- Screw the nuts used to fasten to the engine, tightening to the specified torque.

Locking torques (N*m)

Silencer arm fastening screw **27 - 30 Nm (20 -22 lb*ft)**

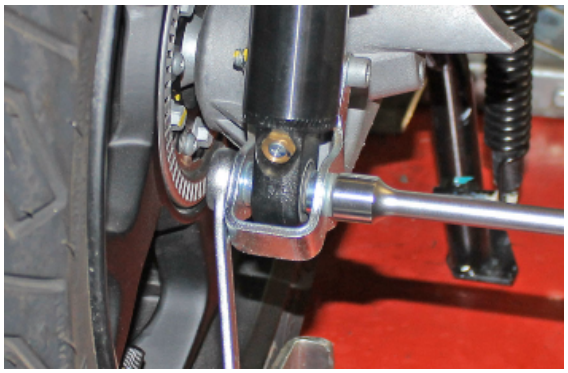
- Screw the two upper screws of the cover.
- Refit the exhaust silencer.



- Put back the right shock absorber and tighten the fastening to the recommended torque.

Locking torques (N*m)

Lower shock absorber clamp 40 - 45 Nm **Shock absorber upper clamp** 40 - 45 Nm

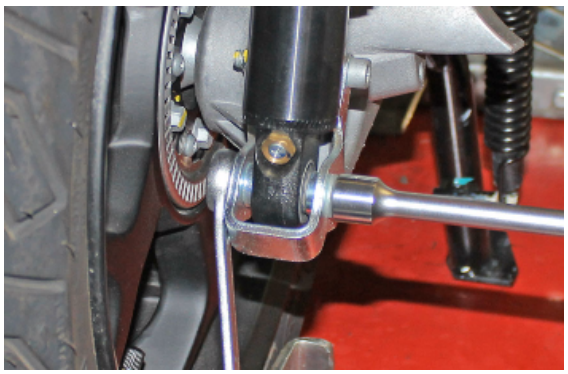


Refitting

Carry out the previous operations but in reverse order.

Locking torques (N*m)

Lower shock absorber clamp 40 - 45 Nm **Shock absorber upper clamp** 40 - 45 Nm



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System ASR

ASR SYSTEM

The ASR system is a driving aid that assists the driver in acceleration manoeuvres, particularly on low-grip surfaces or under conditions that can cause sudden back-wheel slippage. The ASR in these situations automatically intervenes by reducing engine output within the limit imposed by the grip conditions, contributing significantly to the maintenance of stability the vehicle.

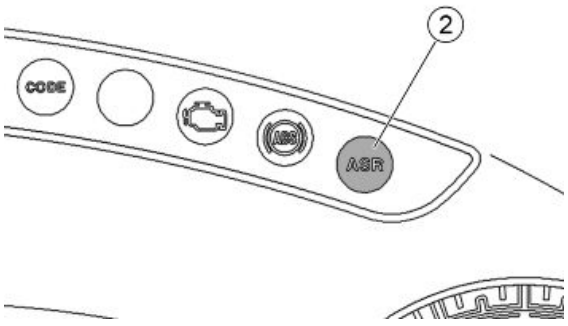
WARNING

THE ASR SYSTEM IS BASED ON THE RECOGNITION OF SPEED DIFFERENCES BETWEEN FRONT AND REAR WHEEL. IN ORDER FOR THE SYSTEM TO MAINTAIN MAXIMUM EFFICIENCY IN ALL CONDITIONS, THE CALIBRATION PROCEDURE MUST BE PERFORMED EVERY TIME, EVEN IN CASE OF REPLACEMENT OF JUST ONE TIRE. FOR THE CALIBRATION OF THE CONTROL UNIT PERFORM THE PROCEDURE BELOW.

- ASR BUTTON 1: activation / deactivation.
- ASR WARNING LIGHT «2»: operating indication warning light.

Warning light flashing mode:

- Off with the vehicle in gear:: the system is working, but is not active (normal condition).
- Flashing quickly with moving vehicle: The system is functioning correctly and is active (poor grip conditions, engine power limiting in effect); ride with extreme care, as the grip limit has been exceeded; restore the vehicle to safety conditions by gently reducing the throttle opening.
- Lit with moving vehicle: the system is disabled and will not intervene in case of loss of grip.



- If the deactivation was voluntary (by pressing the appropriate button "1" for 1 second) it is recommended to reactivate the system as soon as possible.

- If the system was NOT deactivated voluntarily, this indicates an ASR system fault.

To ensure maximum safety of the vehicle it is advisable to keep the system active. Deactivation may be necessary only in case of starting with very low grip surfaces (mud, snow) on which the operation of the ASR could actually prevent the movement of the vehicle.

N.B.

AT VEHICLE START-UP THE ASR WARNING LIGHT FLASHES AT THE SAME FREQUENCY AS THE ABS WARNING LIGHT, INDICATING A DIAGNOSTIC PHASE OF THE SYSTEM. IN THE ABSENCE OF ERRORS, BOTH WARNING LIGHTS TURN OFF AT THE SAME TIME WHEN EXCEEDING 5 km/h.

WARNING

THE ASR SYSTEM IS ACTIVATED AT EVERY "ON" POSITIONING OF THE IGNITION SWITCH.
IF DISABLED BY THE USER, THE ASR SYSTEM KEEPS THE STATE OF INACTIVITY ONLY IF THE VEHICLE IS OFF, BY USING THE ENGINE STOP SWITCH; AT THE NEXT KEY ON THE ASR SYSTEM IS ENABLED AUTOMATICALLY.

CAUTION

IT IS EMPHASISED THAT THE RIDING AUXILIARY SYSTEM CANNOT CHANGE THE PHYSICAL LIMITS OF GRIP AND IS NOT A SUBSTITUTE FOR PROPER MANAGEMENT OF POWER, BOTH ON STRAIGHT STRETCHES AND IN TURNS. THEREFORE, IT IS RECOMMENDED TO ALWAYS USE THE VEHICLE WITH THE UTMOST CARE AND IN ACCORDANCE WITH THE REGULATIONS IN FORCE.

CAUTION

AT LOW SPEED, LESS THAN 5 Km/h (3 mph), THE ASR SYSTEM IS NOT OPERATIONAL.
IT IS RECOMMENDED TO PAY PARTICULAR ATTENTION IN THE EVENT OF ACCELERATION FROM STANDSTILL IN CONDITIONS OF LOW GRIP, ESPECIALLY IN THE FIRST METRES.

N.B.

IN CASE OF ROAD DISCONNECTIONS THERE COULD BE SHORT ACTIVATIONS OF THE ASR SYSTEM. SUCH EVENT APPEARS UNDER NORMAL OPERATION CONDITIONS OF THE VEHICLE.

WARNING

THE ASR SYSTEM PREVENTS THE APPLICATION OF HIGH SPEED ROTATION ON THE REAR WHEEL WITH THE VEHICLE ON THE CENTRE STAND.
IT IS RECOMMENDED TO NOT INSIST WITH THE THROTTLE GRIP IN THIS SPECIFIC SITUATION, BECAUSE THIS MAY CAUSE ABNORMAL STOPS AND/OR DAMAGE TO THE CATALYSTS.

CAUTION

IN THE EVENT OF MALFUNCTION OF THE BATTERY, THE ABS - ASR SYSTEM TURNS OFF.

ASR INDICATOR LIGHT OPERATING MODE

ASR SYSTEM STATUS	ASR INDICATOR LIGHT WITH THE ENGINE SWITCHED OFF OR THE KEY TO "ON"	ASR INDICATOR LIGHT WITH THE ENGINE SWITCHED ON AND THE VEHICLE RUNNING	ASR RUNNING WHILE DRIVING (LOW GRIP CONDITIONS)
ASR ACTIVE and calibrated	"ASR" icon: 1 Hz slow flashing	"ASR" icon: Off	"ASR" icon: 5 Hz fast flashing
ASR ACTIVE not calibrated	-	"ASR" icon: on steady	"ASR" icon: 5 Hz fast flashing
ASR voluntarily deactivated	"ASR" icon: on steady	"ASR" icon: on steady	-
ASR system not working (fault)	"ASR" icon: on steady	"ASR" icon: on steady	-
ASR programming phase (successful)	-	"ASR" icon: 1 Hz slow flashing; at the next engine start, the icon is off if the programming failed.	-
ASR programming phase (failed)	-	"ASR" icon: switched on steady at the next engine start if the programming has failed.	-

ASR SYSTEM CALIBRATION PROCEDURE

To keep the efficiency of the ASR **system after replacing one or both tires, the calibration of the system** must be performed according to the following methods:

• Wait until the diagnostic phase of the ASR and ABS systems is complete;

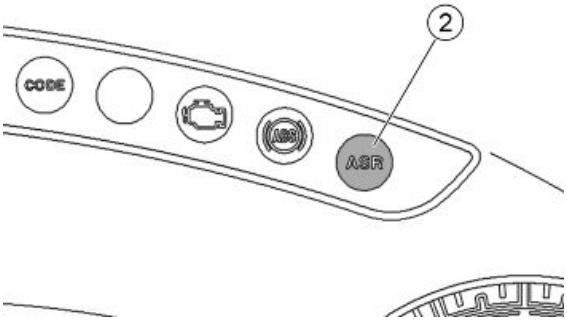
• **Start the engine and drive a short straight stretch of flat road above 5 km / h (3.1 mph)** and wait for the flashing of the two ABS and ASR indicator lights to switch off;

• **Stop** and allow the engine to run in idle for at least **5 seconds**;

• **Press the ASR button "1"** and **the START button for at least 3 seconds.**

• **The activation of the wheel radius learning procedure** or of the ASR calibration procedure **will be confirmed by the ASR indicator light "2" with slow flashing.**

• **Accelerate to a constant speed of** 30-40 km/h (18.6-**24.8 mph)** and maintain it for **at least 8 seconds**. The permanence of the vehicle speed in the correct range for the completion of the procedure is confirmed by the fast flashing of the ASR warning light «**2**».



• **The completion of the procedure** will be indicated by the ASR indicator light **"2"** and now the ASR system **is functional**.

• **To memorize** the procedure, **switch off the engine, turn the ignition switch to "OFF" and wait for at least 60 seconds** before switching again to "**ON**" and engaging a gear.

• **Complete the procedure within 5 minutes;** if the **ASR indicator light "2" stays on steady,** it means that the **ASR procedure has failed**.

Therefore, it is necessary to repeat the ASR calibration procedure until it is successfully completed.

Regarding the ASR indicator light after programming:

- Procedure OK: ASR indicator light OFF and the system active. At the next key "ON", the new wheel radius will be memorized.
- Procedure failed: The ASR indicator light STEADILY ON and the system active (for safety purposes) with the previously memorized or the default wheel radius (if it has never been programmed).